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THE NORTH CAROLINA

AGRICULTURAL EXPERIMENT STATION,

W. A. WITHERS, A. M., ACTING DIRECTOR.

Report of the Director

FOR 1897 AND 1898 (HALF YEAR).

20TH AND 21ST YEARS.

RALEIGH, N. C.

494

Publications will be sent to any address in North Carolina upon application.

NORTH CAROLINA COLLEGE OF AGRICULTURE AND MECHANIC ARTS,

RALEIGH, N. C.

THE NORTH CAROLINA

AGRICULTURAL EXPERIMENT STATION

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B. S. SKINNER	Superintendent of Farm.
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MISS M. S. BIRDSONG	Stenographer.
MRS. L. V. DARBY	Stenographer.

The Director's office is in the main building of the College. Telephone No. 135 C. The street cars pass within one hundred yards of the College building. The Station is glad to receive any inquiries on agricultural subjects. *Address all communications to the Agricultural Experiment Station, and not to individuals.* They will be referred to the members of the Station staff most competent to answer them.

RALEIGH, N. C., August 1, 1898.

To His Excellency, DANIEL L. RUSSELL,
Governor of North Carolina.

SIR: I have the honor to submit herewith a report of the operations of the North Carolina Agricultural Experiment Station from January 1, 1897, to June 30, 1898.

This report is made in accordance with the following portion of Section 3, of the Hatch Act, of the Congress of the United States for the maintenance of Agricultural Experiment Stations in the various States and Territories.

"It shall be the duty of each of the said Stations, annually, on or before the first day of February, to make to the Governor of the State or Territory in which it is located, a full and detailed report of its operations, including a statement of receipts and expenditures."

Trusting that this report will prove satisfactory to your Excellency, I am,

Very respectfully yours,
J. C. L. HARRIS,
President Board of Trustees.

THE NORTH CAROLINA
COLLEGE OF AGRICULTURE AND MECHANIC ARTS,
PRESIDENTS OFFICE.
RALEIGH, N. C., August 1, 1898.

HON. J. C. L. HARRIS,
President Board of Trustees.

SIR: I transmit herewith the report of Professor W. A. Withers, Director of the North Carolina Experiment Station from January 1, 1897, to June 30, 1898, inclusive. It furnishes a full and clear statement of the work of the Station, together with many gratifying evidences of steady growth and increased usefulness to the State under its present head. I have the honor to be

Very respectfully,
ALEX. Q. HOLLADAY,
President.

THE NORTH CAROLINA
AGRICULTURAL EXPERIMENT STATION,
OFFICE OF THE DIRECTOR.
RALEIGH, N. C., August 1, 1898.

To ALEX. Q. HOLLADAY, LL.D., *President*
of the N. C. College of Agriculture and Mechanic Arts.

SIR: I have the honor to submit herewith a report of the operations of the North Carolina Agricultural Experiment Station, for the year and a half ending, June 30, 1898. The work for the first six months of this period was performed during the Directorship of Dr. H. B. Battle.

This report covers the work of the Station for the twentieth year and a portion of the twenty-first year. It is made in accordance with Section 3, of the Hatch Act, of the Congress of the United States, for the maintenance of Agricultural Experiment Stations in the various States and Territories.

The previous Annual Reports of the Station cover periods ending with December 31, of each year. The present report is arranged so as to cover the work of the fiscal year ending June 30, in accordance with the wish of United States Department of Agriculture, expressed to me in a letter which is appended hereto.

I trust the report will prove satisfactory to yourself, the Board of Trustees and His Excellency, the Governor of the State, to whom I should be pleased for you to transmit it in accordance with the law above referred to.

Very respectfully,
W. A. WITHERS,
Acting Director.

[COPY.]

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS.

WASHINGTON, D. C., June 29, 1897.

DEAR SIR: The Experiment Stations in fifteen States now make the Annual Reports of their operations as well as their Financial Reports, cover the fiscal year ending June 30. Now that this Department is required to make a report to Congress on the work and expenditures of the Stations for each fiscal year, it would be better, as far as we are concerned, if it was the uniform practice of the Stations to make their Annual Reports for the fiscal year. There is nothing in the Hatch Act to forbid this. That act simply calls for an Annual Report without defining exactly the period to be covered. Will you kindly inform me whether there is anything in the laws of your State which would prevent a change in your practice in this regard or any other good and sufficient reasons for making your report cover a period other than the fiscal year?

If we could receive the report of the work and expenditures of all the Stations by September 1, it would enable us to make our report to Congress at the opening of the session in December. It would then receive proper consideration by the committees in connection with the appropriation bill. As it is now, the information available for these committees is a year old when the report is considered and may unfairly represent the condition of affairs at a number of the Stations at that time.

Very truly yours,
(Signed) A. C. TRUE,
Director.

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REPORT OF THE DIRECTOR

OF THE

N. C. AGRICULTURAL EXPERIMENT STATION;

FOR THE HALF YEAR ENDING JUNE 30, 1897, AND FOR THE YEAR ENDING JUNE 30, 1898; 20TH AND 21ST YEARS.

The North Carolina Agricultural Experiment Station was established in March, 1877, with a two-fold object in view:

First, To act as a Fertilizer Control Station; and second, as an Agricultural Experiment Station in the true sense of the word. Until 1887 the Station was supported entirely by the State from the tax on fertilizers, but by legislative enactment of that year it received the fund derived from the United States Hatch Act for the maintenance of Experiment Stations in the various States and Territories, and therefore the scope of the work was largely increased. The Station receives at present, also, a sum from the North Carolina Department of Agriculture for conducting the analytical work of the Fertilizer Control.

SCOPE OF WORK.

I. CHEMICAL AND MICROSCOPICAL WORK, including—
  1. The analysis of fertilizers legally on sale in the State.
  2. The analysis of agricultural chemicals, of composts and home-made fertilizers, and all materials from which they can be made.
  3. The analysis of marls and mucks.
  4. The analysis of feeding-stuffs.
  5. The examination of seeds with reference to their purity, and capacity to germinate.
  6. The examination of grasses and weeds.
  7. The study of insects injurious to vegetation.
  8. The analysis of milk, butter and other dairy products.
  9. Investigation of fungous diseases of plants, and remedies designed to eradicate them.
  10. Such other chemical and microscopical investigations as are demanded from time to time.

II. EXPERIMENTAL WORK IN THE FIELD, STABLE AND DAIRY, including—
  1. The effect of different fertilizers on various soils of the State.
  2. The study of improved methods for the cultivation of the staple crops.
  3. The study of the best treatment of worn-out lands.
  4. The study of the best system for the rotation of crops.
  5. Chemical investigations, with practical experiments with cattle, on the value of the various forage crops, especially those common in North Carolina.
  6. Investigations upon the growth of new crops for this climate, in comparison with those we now have.
  7. The construction of the silo, and value of ensilage.
  8. The study of the growth of cattle using different feeding-stuffs.

9. Investigations in the production of milk and butter, under different conditions and with various implements.
10. Digestion experiments with stock, to ascertain the real value of various feeding-stuffs.
11. Experiments with the various feeding rations, to ascertain how far the feeding standards can be relied on.
12. Tests to compare the value of different varieties of fruits, vegetables and other horticultural products.
13. Investigations designed to develope the vineyard and trucking interests of the State.
14. Investigations upon the diseases of cattle and domestic animals, and the dissemination of information concerning the treatment of various diseases.
15. Studies as to the best methods of enlarging the poultry business of the State, and placing it upon a profitable footing.
16. Such other work, from time to time, as may be deemed advisable for the interest of the agriculture of the State.

III. A Bureau of Information upon all subjects connected with the agricultural industries of the State. Under this head is included—

1. Publications of the Stations, embracing five different classes of bulletins and two of reports. These publications contain the results of the investigations carried on, as well as a resume of work done elsewhere, in order instruct or advance the general agricultural interests.
2. Direct correspondence, through the various divisions of the Station, with individual farmers, information being always given as promptly and carefully as possible by those most competent to do so.
3. Personal contact of the Station staff with farmers and others at institutes and fairs, and by visits to farms, etc.

IV. Samples for Examination.—Samples, when sent by citizens of the State, for chemical or other examinations, will be examined and their value reported free of charge, under certain conditions and stipulations—

1. If the experimental work of the Station will not be retarded.
2. If the work is of an agricultural character.
3. If the sample is from the sender's own land.
4. If they are of suffcient public interest, and the Station is free to publish the results.
5. If the samples are taken and sent according to the Station's printed forms, and are fully described.

Divisions of the Station.

In order to facilitate the work of the Experiment Station, it has been subdivided into—

1. Executive Division.
2. Chemical Division.
3. Agricultural Division.
4. Botanical Division.
5. Entomological Division.
6. Horticultural Division.
7. Veterinary Division.
8. Fertilizer Control Division.
9. Division of Publications.

Equipment.

The Director's office is in the Main Building of the North Carolina College of Agriculture and Mechanic Arts. The removal from the Agricultural Building in Raleigh was made on July 14, 1898.

The Experiment Farm is located about one mile and a half west of the city of Raleigh, and adjoins the Fair Grounds of the State Agricultural Society. It is near the College grounds. On the farm are kept located the experimental dairy, silos and barn, in which are the cattle under test for production of milk and for other purposes. Here is also located the poultry work of the Station, comprising eight yards and the necessary equipment for carrying on the work. Field crop tests are also conducted as far as possible upon the land of the farm.

During the period embraced by this Report, Primrose Hall was erected upon the College grounds and is now used for the College and Station work in horticulture, botany and entomology—the botanical and entomological work having been transferred to this hall from the Agricultural Building in Raleigh. A part of the land adjoining this building was assigned for horticultural purposes. A portion of the horticultural work is also done at Southern Pines.

The experimental chemical work is performed in the College laboratories and in the laboratories in the Agricultural Building.

The Fertilizer Control Division occupies the offices and laboratories located upon the main floor in the north wing of the Agricultural Building in Raleigh, immediately north of the State capitol.

Experiment Station Council.

At a meeting of the Board of Trustees held in June, 1897, it was decided to create a Station Council. This Council is composed of the President of the College, and the Professors of Agriculture, Horticulture and Chemistry. The President of the College is President of the Council, the remaining members are respectively Agriculturist, Horticulturist and Chemist of the Station.

The Working Force at the Station.

During the past year and a half several changes were made in the Station staff.

The following connections with the Station were severed: On July 1, 1897, Dr. H. B. Battle, Director; Messrs. B. W. Kilgore, W. M. Allen and S. E. Asbury, Assistant Chemists; and Mr. A. F. Bowen, Secretary. On September 1, 1897, Mr. Gerald McCarthy, Botanist and Entomologist. On February 15, 1898, Mr. S. B. Moore, Clerk, and Mr. L. W. Physioc, Mailing Clerk; on March 31, Mr. J. D. Huffham, Jr., Assistant Chemist.

The following additions were made to the Station staff: On July 1, 1897, W. A. Withers, Chemist; Messrs. C. B. Williams, C. D. Harris, A. W. Blair, J. D. Huffham, Jr., and J. A. Bizzell, Assistant Chemists; Mr. J. M. Fix, Secretary; Mr. S. B. Moore, Clerk; Mr. H. E. King, Chief Clerk of the Fertilizer Control Division. On September 1st, Mr. J. M. Johnson, Assistant Agriculturist, and Mr. C. W. Hyams, Assistant Botanist. On March 15, 1898, Mrs. L. V. Darby, Stenographer. On April 1st, C. M. Hughes, Clerk. On May 1st, Mr. G. S. Fraps, Assistant Chemist.

On March 15th, Mr. F. G. Kelly, who had previously performed clerical duties, began work as Assistant Chemist. The Chemist of the Station was asked to assume also, temporarily, the duties of the Directorship. He has been doing so since July 1, 1897.

PUBLICATIONS OF THE STATION.

The publications of the Station are as follows:

A. ANNUAL REPORTS OF THE STATION.—Each edition 1,000 copies. Numbered consecutively with the years, 1–1878, 2–1879, 3–1880, and so on. Prior to 1888 these reports contained results from the year's work, and took the place of separate Bulletins which appeared thereafter. The Annual Reports now contain copies of the regular Bulletins issued during the year, and are sent to exchanges only, and not to the general mailing list. Latest issued was nineteenth annual for 1896.

B. BIENNIAL REPORT OF THE STATION.—Sent to the Governor for transmission to the General Assembly. Each edition 500 to 3,000 copies, numbered consecutively 1–(1877, 1878), 2–(1879, 1880), 3–(1881, 1882), etc. These reports are demanded by State authorities, and are not intended for general distribution. Latest issue was Ninth Biennial Report for the years 1895 and 1896.

C. BULLETINS—*Regular*. Each edition about 20,000 copies. For popular reading, with the scientific terms avoided as far as possible. Sent to all names on the mailing list. When bulletins more or less technical in character are issued they are sent to the scientific institutions, but notice in regard to them is given to every name upon our mailing list, and the Station is glad to supply them to any who may wish them. The latest issue is No. 151.

D. BULLETINS—*Special.* Each edition, varying in number from 500 to 60,000 copies for special purposes, as occasion demands. Numbered consecutively 1, 2, etc. Sent only to special names, as occasion demands. Latest issue is No. 49.

E. INFORMATION BULLETINS.—Designed for distribution to collect information concerning practical and useful plans of farm management or methods of cultivation of different crops, etc., to be collated thereafter for use in general bulletins. The latest issue is No. 8.

F. BULLETINS—*Press.* Each edition 600 copies. Short reading articles for newspaper columns. First number was May 24, 1890. Sent to newspaper exchanges. Latest issue is No. 78.

G. THE BULLETIN.—This publication is issued monthly under the supervision of the Commissioner of Agriculture, and, among other things, contains popular articles by members of the Station staff, answers to queries and other information of interest to the general public. This publication has, to a large extent, taken the place of our press bulletins.

The three classes of bulletins previously published by the Station in regard to the weather are no longer issued on account of the separation of the State Weather Service from the Experiment Station on October 1, 1896, to which attention was called in a previous report. The special bi-weekly fertilizer Bulletins are no longer issued separately by the Experiment Station, as these analyses are published in The Bulletin under the supervision of the Department of Agriculture.

PUBLICATIONS DURING THE YEAR.

During the period embraced by this Report, publications have been issued, divided as foilows:

Series A—Annual Report of the Station—1 report, containing 88 pages.
" C—Regular Bulletins—16 bulletins, containing 372 pages.
" D—Special Bulletins—10 bulletins, containing 170 pages.
" E—Information Bulletin—2 bulletins, containing 3 pages.
" F—Press Bulletins—2 bulletins, containing 2 pages.
" G—The Bulletin—19 issues, containing 150 pages.

Total during first half of 1897, 20 publications, containing 308 pages, and during the year ending June 30, 1898, 30 publications, containing 477 pages.

Total for year and a half, 50 publications, with 785 pages.

SUMMARY OF PUBLICATIONS ISSUED FROM JANUARY 1, 1897, TO JUNE 30, 1898.

A. OF THE ANNUAL REPORTS OF THE STATION.

No. 19.—The Work during 1896, of the North Carolina Agricultural Experiment Station.

January 9, 1897. 88 pp. Letter of transmittal. Board of Control and staff of Experiment Station. Report of the Director. The Fertilizer Control Station. Agricultural Experiment Station. Divisions of the Station. Equipment. The working force of the Station. The publications of the Station. Summary of publications issued during 1896. Co-operative horticultural work at Southern Pines. Examination of nursery stock. Preparation of the matter for the Bulletin of the Department of Agriculture. Co-operation with the United States Weather Bureau. Legislation in regard to crop diseases. New poultry Division. Forage grasses. The home vegetable garden. Educational bulletins. Acknowledgments. Report of the Agriculturist. Report of the first assistant Chemist. Report of the Botanist and Entomologist. Report of the Horticulturist. Report of the poultry manager. Financial statement. Appendix, containing the opinions of nearly 1,000 North Carolina farmers, representing ninety-five counties, in regard to the work of the North Carolina Agricultural Experimant Station. The value of the Station work as expressed by 146 non-residents from thirty-three States. The value of the Station's work as expressed by fifteen residents of foreign countries. Bulletins 124 to 135, inclusive, issued during 1896.

C. OF THE REGULAR BULLETINS, 16 ISSUES.

No. 136.—Fertilizer Analyses of the Fertilizer Control.

January 12, 1897. 34 pp. Including official analyses of spring and fall samples of 1896. The Fertilizer Control Station. Analyses for 1897. The present fertilizer laws. When analyses of fertilizers are made for farmers. The necessity of accurate sampling. The need of fertilizer analyses, and an explanation of terms used. Terms used in analysis. Phosphoric acid. Nitrogen or ammonia. Potash. Water. Guaranteed percentage. Mechanical condition. Relative seaboard value per ton of unmixed ingredients. How the valuations of constituents are determined. How values per ton are calculated, and how they can be utilized by farmers. Table of freight rates from the seaboard to interior points, and the detailed analyses of all fertilizers during 1896.

No. 137.—A Warning in Regard to Compost Peddlers.

January 20, 1897. 8 pp. Warning to the people of North Carolina against the "Champion Chemical Process Company," or any similar concern operated on the same basis. A copy of the circular distributed by the company, and a discussion of the same.

No. 138.—The San Jose Scale in North Carolina.

January 30, 1897. 14 pp. Plants attacked. Original home. Life history. Methods of dissemination. Natural enemies. Remedies. Seven experimental tests. What to do with the infested nursery stock. Formulas for scale insecticides. Whale oil soap, winter rosin wash, hydrocyanic acid gas: Discussion of the formulas and method of applying. Proposed bill regulating inspection. A paper prepared for the General Assembly on crop pests and their damages.

No. 139.—Home-Mixed Fertilizers and Composts.

February 8, 1897. 16 pp. Introduction. The need of home-mixing of fertilizers. The advantage of compost-making. When to prepare composts. How and where to prepare the compost. How much to apply. How and when to apply. Top dressings. Do not apply fertilizers or composts too near the seed or plant. The use of stable manure. Stable manure composted with other ingredients, to be used in addition to those given in the formulas. Cost of ingredients. Approximate retail cost of fertilizing ingredients in Central North Carolina. Formulas for mixtures and composts. Five formulas for mixed fertilizers, and five for composts for cotton and corn. Four formulas for mixed fertilizers, and five for composts for small grain. Six formulas for mixed fertilizers and four for composts for tobacco. Two formulas for mixed fertilizers for grass. Eight formulas for mixed fertilizers for vegetables. Four formulas for mixed fertilizers for sweet potatoes. Three formulas for mixed fertilizers for peanuts. Four formulas for mixed fertilizers for fruit. Two formulas for mixed fertilizers for cow-peas. Five formulas for mixed fertilizers for top dressing.

No. 140.—Volumetric Estimation of Phosphoric Acid.

May 10, 1897. 8 pp. A further communication on the estimation of phosphoric acid by titration of the ammonium phospho-molybdate precipitate with standard alkali, and comparative phosphoric acid results on various fertilizer materials by gravimetric and volumetric methods.

No. 141.—A New Tobacco Pest.

July 21, 1897. 8 pp. Description of the tobacco miner. Remedies. Two cuts.

No. 142.—Comfortable Low Cost Barns.

August 23, 1897. 20 pp. Cheap small barn for a correspondent. Barn for the State Geological Survey. Still another cheap barn. Circular barn, and yards for thirty cows. North Carolina Experiment Farm barn. 13 cuts.

No. 143.—Feeding Experiments, Milk Records, Etc.

September 30, 1897. 36 pp. Comparative effect of some rations fed to milch cows. Effect of changes of food. Table of temperature in Experiment Farm barn. Conclusion. Rations calculated to digestible constituents for 1,000 pounds live weight. Is skim, or buttermilk, best for pigs? Tables of feed and results. Summary of record of milk and butter production of station herd 1895 and 1896. Note on records of cows for 1896. Tables giving value of product and of food consumed and prices paid for food. Experiment Farm barn, well suited for animal comforts. Table of stable temperature record.

No. 144.—Ornithology of North Carolina.

October 30, 1897. 36 pp. A list of the birds of North Carolina; with notes of each species, arranged by famlies with index. The list includes 303 species, with 22 which would seem to be found on the coast or within the borders of the State. Map of North Carolina.

No. 145.—Crimson Clover.

December 22, 1897. 20 pp. Experiments at the North Carolina Agricultural Experiment Station. Press Bulletins on crimson clover. Crimson clover among North Carolina farmers. Questions asked and summary of replies. Reported failures. Conclusions generally favorable. Serious losses from feeding over-ripe crimson clover hay. Early and recent introductions of crimson clover into North Carolina.

No. 146.—Miscellaneous Farm Bulletin.

December 31, 1897. 16 pp. A small variety test of cow-peas. Test of effect of chemical manure and cotton-seed meal on the germination of wheat. A variety test of cotton. Some experiments with potatoes. Tables.

No. 147.—A Study of Lettuces.

June 6, 1898. 8 pp. The results of a varietal test of lettuces, for the benefit of the lettuce growers of North Carolina.

No. 148.—Digestion Experiments and Pasteurization of Milk.

June 8, 1898. 32 pp. Hay alone, and in rations with cotton-seed meal. Crab-grass hay. Tables showing percentage composition of foods, waste and solid excrement, nutrients consumed and excreted with percentages digested. Pasteurization of milk. Table showing how temperature of milk follows that of water in controlled pasteurization. One cut.

No. 149.—The Apple in North Carolina.

June 11, 1898. 22 pp. Analyses of the apple tree and its products. Seedlings vs. grafted fruit trees. Where apples will grow. What kind of trees to plant. What age to plant trees. Preparation of the land for the orchard. How far apart to plant trees. When to plant. How to plant a tree. Laying off the rows. Pruning the tops. Pruning the growing tree. Cultivation of apple orchards. Do not pasture the orchard. Manuring the orchard. General treatment. What varieties of apples shall we plant? Summer apples. Fall apples. Winter apples. Varieties for Eastern North Carolina. For midland North Carolina. For Western North Carolina. Crab apples. Gathering and marketing apples. How to gather apples. Keeping winter apples. Fungous diseases of the apple. Insect enemies of the apple. Composition of spraying mixtures.

No. 150.—Medicinal Plants which have been collected and used in North Carolina.

June 13, 1898. 84 pp. 833 varieties arranged by families. The Bulletin is aimed as a record and not an endorsement of the medicinal properties of any plant. An index is added giving also the more common name.

No. 151.—The Fertilizer Control During 1897.

June 15, 1898. 12 pp. Publications containing fertilizer analyses. Relation of the Station to the fertilizer control. Firms which registered brands for sale in North Carolina during 1897. Extent and distribution of the trade. Valuation of fertilizers and how they are determined. Average precentage composition of fertilizers on sale in North Carolina for several years. Increase of number of brands and the difficulty in a proper control. General conclusions.

D. OF THE SPECIAL BULLETINS, 10 ISSUES.

No. 40.—Fertilizer Analyses of the Fertilizer Control.

February 20, 1897. 14 pp. First bi-weekly edition, season of 1897. The present fertilizer laws. New plan for stating the analyses of fertilizers. Terms used in an analysis. How the valuations of constituents are determined. How values per ton are calculated and how they can be utilized by farmers. Table of freight rates from the seaboard to interior points. Analyses of 53 samples analyzed by the fertilizer control.

No. 41.—Fertilizer Analyses of the Fertilizer Control.

March 6, 1897. 16 pp. Second bi-weekly edition, season of 1897. Contents similar to No. 40. Analyses of 92 samples analyzed by the fertilizer control.

No. 42.—Fertilizer Analyses of the Fertilizer Control.

March 20, 1897. 22 pp. Third bi-weekly edition, season of 1897. Contents similar to No. 40. Analyses of 148 samples analyzed by the fertilizer control.

No. 43.—Fertilizer Analyses of the Fertilizer Control.

April 3, 1897. 24 pp. Fourth bi-weekly edition, season of 1897. Contents similar to No. 40. Analyses of 193 samples analyzed by the fertilizer control.

No. 44.—Fertilizer Analyses of the Fertilizer Control.

April 17, 1897. 28 pp. Fifth bi-weekly edition, season of 1897. Contents similar to No. 40. Analyses of 245 samples analyzed by the fertilizer control.

No. 45.—Fertilizer Analyses of the Fertilizer Control.

May 11, 1897. 32 pp. Sixth bi-weekly edition, season of 1897. Contents similar to No. 40. Analyses of 281 samples analyzed by the fertilizer control.

No. 46.—Fertilizer Analyses of the Fertilizer Control.

May 22, 1897. 8 pp. Seventh bi-weekly edition, season of 1897. Issued as a supplement to No. 45. Analyses of 42 additional samples analyzed by the fertilizer control.

No. 47.—Fertilizer Analyses of the Fertilizer Control.

June 26, 1897. 12 pp. Eighth bi-weekly edition, season of 1897. Issued as a supplement to No. 46. Analyses of 103 additional samples analyzed by the fertilizer control.

No. 48.—The North Carolina Agricultural Experiment Station.

October 20, 1897. 12 pp. Pamphlet descriptive of the work of the Station and its exhibit at the Annual Fair of the North Carolina Agricultural Society.

No. 49.—Sugar Beets.

March 12, 1898. 2 pp. Directions in regard to soil, fertilizers, and the planting of sugar beets.

E. OF THE INFORMATION BULLETIN, 2 ISSUES.

No. 7.—July 27, 1897. 1 p.

Inquiries as to pests of tobacco.

No. 8.—February 28, 1898. 2 pp.

Inquries as to dairying and markets for dairy products in North Carolina.

F. OF THE PRESS BULLETINS, 2 ISSUES.

No. 77.—February 1, 1898. 1 p.

Article: Concerning publication of fertilizer analyses by the Department of Agriculture, instead of Experiment Station.

No. 78.—February 17, 1898. 1 p.

Article: Sugar-beet seed for distribution by the Experiment Station.

G. THE BULLETIN OF THE NORTH CAROLINA DEPARTMENT OF AGRICULTURE, 7 ISSUES.

January, 1897. 4½ pp.

Articles: Improve your stock. White specs or frogs eye of tobacco. Year book of the Experiment Station for 1894. Two and two make four. Decomposing old bones without grinding. Improving land for grass. Tread-power for dairy purposes, churns, butter-workers, etc. Tobacco stems as a fertilizer. Propagating the scuppernong grape-vine.

February, 1897. 3 pp.

Articles: A possible cotton pest. Look out for cut-worms. The Experiment Station year-book for 1895. A warning in regard to compost peddlers. The so-called dissolved bone. Ensilage for horses. Crops for truck in central North Carolina. Dairy Journal. Pit for keeping milk and butter. Shade trees for lawns.

March, 1897. 7 pp.

Articles: Commercial fertilizers. New plan for stating the analyses of fertilizers. Do not buy nursery stock from unreliable parties. Ramie. North Carolina Experiment Station sugar-corn. Table containing ninety-two fertilizer analyses at Experiment Station for the State Board of Agriculture.

April, 1897. 8 pp.

Articles: That compost peddler. What shall we feed the work mule? Preservatives for milk and cream,—let them alone. Table containing 217 fertilizer analyses made, by North Carolina Experiment Station for the State Board of Agriculture.

May, 1897. 4 pp.

Articles: How to use fertilizers. New forage and fibre plants. Some cheap, coarse cattle food. Do not give up the fight too soon. Look out for cattle flies. Depreciation of fertilizers. Feeding problem. Pruning a pear tree. A ration for dairy cow. Variety of muskmelon. Buckwheat.

June, 1897. 8 pp.

Articles: Rotation for a forty-acre field. Poultry pointers for summer. Table containing 217 fertilizer analyses made at the North Carolina Agricultural Experiment Station for the Board of Agriculture.

July, 1897. 13½ pp.

Articles: Fruit nurseries needed in North Carolina. The American hen. What to plant in the corn field. Culture of ramie. Novelties in forage plants. Chickens for general use. Hogs and feeding, carrots, turnips, etc. Fertilizer for strawberries. Crimson clover for horses. Soil and fertilizer for celery. Table containing 217 fertilizer analyses, made at the North Carolina Experiment Station, for the Board of Agriculture.

North Carolina State Library
Raleigh

G. THE BULLETIN OF THE AGRICULTURAL EXPERIMENT STATION OF NORTH CAROLINA, 12 ISSUES.

September, 1897. 13 pp.

Articles: Natural plant food. Warning to purchasers of nursery stock. A new shade-tree pest. Practical poultry pointers. A new disease of asparagus. Inspection of nurseries. Cabbage blight. Weeds in the clover field. Cooked cotton seed as a human food and as a feed for stock. Fertilizer for wheat. Curing of corn. Table containing 217 fertilizer analyses made by the North Carolina Experiment Station for the Department of Agriculture.

October, 1897. 11 pp.

Articles: Examination of nursery stock. Nurseries outside of North Carolina which have filed certificates of examination. Laws affecting the sanitary arrangements for stock, etc., and their relation to the public health. Remedy for moles. Some agricultural and horticultural books. Fertilizer for wheat. Street shade trees. Two hundred and seventeen fertilizer analyses by the North Carolina Agricultural Experiment Station for the Board of Agriculture.

November, 1897. 8 pp.

Articles: Examination of nursery stock. Nurseries outside of North Carolina which have filed certificates of examination. Crimson clover seed. Treatment of bones on the farm. Testing the health of the dairy herd. Rotation of crops. Fruit. Acid phosphate. Ration for cows. Gathering and curing corn. Ninety-eight analyses of fall samples of fertilizers by the North Carolina Agricultural Experiment Station for the North Carolina Department of Agriculture.

December, 1897. 11½ pp.

Articles: Request of breeders of stock. Examination of nursery stock. Nurseries outside of North Carolina which have filed certificates of examination. Improving native grass. Cotton-seed meal for cattle. Cattle suitable for Western North Carolina. Insect pests of chestnuts and English walnuts. Acid phosphate and high grade fertilizers. Fertilizer for strawberries. Cotton-seed meal for a feed and fertilizer. Sun-flower seed. Clover parasite. Fertilizer for strawberries. Ashes. Hedges. January poultry notes. Note in regard to fertilizer analyses. Table containing analyses of 131 samples of fertilizers for the Department of Agriculture.

January, 1898. 9½ pp.

Articles: Note on fertilizer bulletins. Pure food congress. Pea threshers. Pure food legislation. Sugar-beet seed for distribution. Sugar-beet in North Carolina. Improvement of land. Irish potatoes. The wide tire. Fertilizer for sweet potatoes. Cotton-seed meal and kernels. Sheep-raising. Worth of soda as a top dressing. Lime in the compost heap. Feeds and fertilizers. Remedy for the escape of ammonia from the manure pile. Leaves and their fertilizing value. Onions. Velvet bean. Ashes as a top dressing. Fertilizers for Irish potatoes and strawberries. Tobacco stems for trees.

February, 1898. 6½ pp.

Articles: National legislation for nurserymen. The commission for controlling crop pests. Note on fertilizer bulletins. Fertilizer analyses for 1898. Preparation of samples. Plan of reporting analyses of fertilizer. Terms used in analysis. Methods of analysis. Guaranteed percentages. Mechanical condition. Valuations. How values per ton are calculated, and how they can be utilized by farmers. Table of freight rates from the seaboard to interior points. The Experimental Farm of the State Horticultural Society at Southern Pines. Poultry at the Experiment Station. Station stock among the farmers. Some butter sales. Apples suitable for Eastern North Carolina. Rape culture. Time of pruning apple trees. A butter-maker's difficulty. Table containing thirty-eight fertilizer analyses for the Department of Agriculture.

March 15, 1898. 3½ pp.

Articles: Table of freight rate from seaboard to interior points. Note in regard to fertilizer analyses for 1898. Preparation of samples. Plan of reporting analyses of fertilizers. Terms used in an analysis. Table containing sixty-eight fertilizer analyses for North Carolina Department of Agriculture.

March 31, 1898. 6 pp.

Articles: Rheumatism in hogs. Cotton-seed meal. Onions, cantaloupes and cucumbers. Some fertilizer hints. Giant beggar-weed. Utilization of offal from herring fisheries. How to apply stable manure. Fertilizer for sweet patatoes. Table containing ninety-nine fertilizer analyses for the North Carolina Department of Agriculture.

April 15, 1898. 5½ pp.

Table containing 192 fertilizer analyses for the North Carolina Department Agriculture.

May 1, 1898. 10 pp.

Articles: A dairy inspection. Comparative results from fertilizers. Fertilizer for tobacco. Sheep. Reduction of bones. Spray for apple trees. Analysis of soil. A spray for apple trees. Box lye for plants. Table containing 240 fertilizer analyses for the North Carolina Department of Agriculture.

May 15, 1898. 7½ pp.

Table containing 282 fertilizer analyses for the North Carolina Department of Agriculture.

June 1, 1898. 10 pp.

Articles: Handling the apple crop. Fire blight. Effect of lime in the compost heap. Table containing 344 fertilizer analyses for the North Carolina Department of Agriculture.

Co-operative Horticultural Work at Southern Pines.

This work is divided into two departments—the fruit department, which was established in 1895, and the vegetable department, which was established in 1896. The work was instituted to study the effects of different proportions of nitrogen, phosphoric acid and potash, and the proportions best suited for the fruit and vegetable crops grown in that section. These farms are located in Moore county, N. C., near Southern Pines, and have been alluded to in previous reports. The work is under the supervision of a committee composed of representatives from the State Horticultural Society, the Experiment Station and the German Kali Works. The representatives at present are as follows: Mr. J. Van Lindley, President; Mr. Thos. L. Brown, Secretary; and Mr. P. H. Beck, of the Horticultural Society; Dr. B. Von Herff, of the German Kali Works; Prof. W. A. Withers, Acting Director, and Prof. W. F. Massey, Horticulturist, of the Experiment Station. Prof. W. A. Withers is Chairman of the Supervising Committee, Prof. Massey is Horticulturist, and Mr. A. Rhodes, Assistant Horticulturist of the Station, is the Superintendent of the Farm. The chemical work and work of supervision are performed without compensation by the members of the staff of the Experiment Station. The German Kali Works contributes a sufficient amount to cover other expenses incurred in the management of the farms. The report for 1895 has been issued. The reports for 1896 and 1897 have been delayed for various reasons, but will doubtless be issued soon.

THE EXAMINATION OF THE NURSERY STOCK.

Attention was called early in 1897 by the Experiment Station to the fact that the San Jose scale, which had proven so injurious to the fruit trees in other States, had made its appearance in North Carolina. A bill was framed by the Experiment Station, endorsed by the State Horticultural Society, the Board of Agriculture, and other organizations of influence, and finally enacted into law by the General Assembly. The law, as enacted, creates the North Carolina Commission for Controlling Crop Pests, and makes its membership the Commissioner of Agriculture, the Director of the State Agricultural Experiment Station, and the President of the State Horticultural Society. The Director is Chairman of the Commission. Authority is given to this Commission to adopt such regulations for the shipment of nursery stock to consumers in North Carolina as may be deemed necessary, and not inconsistent with the constitution and the laws of the State or the United States. Eight circulars have been issued cantaining the regulations adopted by the Commission in regard to inspection and shipment of nursery stock. Since that time the nurseries of the State have been regularly inspected, and an attempt has also been made to impress upon the owners of orchards the importance of exterminating the scale. A full and detailed report will be made to the Legislature of 1899 in regard to the work of the Commission.

MATTER FOR "THE BULLETIN."

At the request of the Commissioner of Agriculture, the Experiment Station furnishes, each month for publication, in the Bulletin of the Department, various articles of popular interest relating to the work of the Experiment Station. It furnishes, also, such replies to letters received as are deemed of general interest. With the issue of July, 1897, this publication ceased to exist as the Bulletin of the Department. Its successor is "The Bulletin of the Agricultural Experiment Station of North Carolina," which is published monthly under the supervision of the North Carolina Department of Agriculture. The first issue bears date of September, 1897. Through the medium of these publications the Experiment Station has furnished, during the past year and a half, 148 articles and 15 tables containing, analyses of fertilizers, and covering in all 150 pages of printed matter.

Farmers' Institutes.

During the summer of 1897 Institutes were held in 24 counties under the auspices of the Department of Agriculture. By invitation of the Commissioner of Agriculture, the Experiment Station participated in this work, and, with few exceptions, had some representative present at every institute. Good has doubtless been accomplished by our efforts to reach, in person, the farmers of the State. It is to be hoped that as the years go by the people of North Carolina will more fully appreciate this important means of stimulating thought along agricultural lines, and that they will give the representatives of the Station an opportunity of forming their acquaintance.

Correspondence.

Next after publications, the most important agency for bringing the Station into contact with the people of the State is through correspondence. The letters amount to about ten thousand annually, in addition to the requests received for publications. These letters contain queries of almost every conceivable nature in regard to agriculture. Although the labor involved in replying to these numerous letters makes heavy demands upon the time of the staff, it is felt that the number of the letters is an indication of high appreciation of what is being accomplished. It is a matter of pleasure, apart from duty, to aid the agricultural interests of the State in this way. The answers to the letters of greatest general interest are published in the Bulletin.

Feeding Experiments.

Some time ago the Experiment Station undertook the study of the digestibility of various stock-feeds used in the State. This work is still in progress. During the period embraced by this Report, experiments were made on the digestibility of crab-grass hay, cow-pea meal, corn bran, green rape and rice bran. A pig-feeding experiment was also terminated.

Testing For Tuberculosis.

During the year 1897 Tuberculosis made its appearance in the Experiment Station herd. By the Tuberculin test six animals were condemned and slaughtered. Some of the animals were very valuable, and their slaughtering resulted, of course, in much loss to the Station. While the necessity for slaughtering was a matter of regret, it is felt that the wide publicity given to it served to call attention to danger of Tuberculosis in a rather emphatic way, and the result accomplished, in arousing the public interest, has been very gratifying to the Station. Although the Tuberculin test is recognized in many States, yet there are those who express doubt in regard to its reliability as an indication of the presence of Tuberculosis. But, notwithstanding this, information is wanting as to one who is willing to drink milk from cattle which have been condemned by the Tuberculin test, unless the milk has first been pasteurized or sterilized.

During the past year the Station has made tests of various herds in the State, and now some of the stock raisers advertise the fact that their cattle do not react with the Tuberculin test. It seems that the sentiment in favor of the test is growing. The Station will continue to agitate the matter, feeling that the condemnation of Tuberculous cattle by this test cannot fail to result in the improvement of the health of the people.

Field Crop Tests.

Upon the Experiment Farm, during the past year, some variety tests were made with potatoes. The Station also made some tests with peanuts, cow-peas, velvet-beans, hemp, soiling crops and crimson clover.

Poultry Keeping.

In the poultry work such cheap appliances were used as could be made by any one raising poultry under the ordinary farm conditions. The poultry experiments for 1897 were aimed to be with pure bred instead of cross bred fowls. Hatching and rearing, both artifically and naturally, noting cost, and health of various breeds under different conditions, were to receive careful attention. Unfortunately, however, the reports were destroyed by fire, and there is a much smaller number of results for publication than would be otherwise. Feeding experiments were conducted with the various breeds and a careful record kept of the cost, health, etc. Some disease experiments have been made on birds belonging to others.

Horticultural Experiments.

On account of the co-operative experiments of the Station at Southern Pines, a large part of the work of the Horticultural Division was transferred to that place from Raleigh, and the larger part of the work of the Horticulturist has been as Horticulturist of the Supervising Committee. In addition to this co-operative work, however, a small portion of land was leased at Southern Pines, and experiments have been made upon it. Among these would be mentioned some co-operative work with the United States Department of Agriculture in determining the difference in some species of trees from the seeds collected in different altitudes and climates, in the growing of flowering bulbs for market, and in the variety tests of melons. Some variety tests with lettuces have been made. Attention has been called to the use of glass in market-gardening. Experiments have been made in forcing tomatoes and snap-beans.

BOTANICAL INVESTIGATIONS.

Experiments were begun with edible and poisonous mushrooms and on the medicinal plants of the State with a view to cultivating and improving them. Tests were also begun of various forage, fibre and economic plants. The Station is endeavoring to complete its herbarium collection of the native plants of the State. During the summer the Assistant Botanist will be engaged in this work in Western North Carolina. A bulletin has been issued containing a list of the medicinal plants which have been collected and used in the State. It is hoped this bulletin will prove valuable as a record.

ENTOMOLOGICAL WORK.

In January, 1897, this Station called attention of the people to the appearance of the dreaded San Jose scale in the State. Means were suggested for its destruction and for preventing its spreading. In connection with the Commission for Controlling Crop Pests, the Entomologist of this Station made an inspection during the spring and fall of 1897 of the nurseries of the State. Many specimens of twigs infested with various insect pests have been forwarded to the Station. These have been identified and remedies suggested when known.

EXPERIMENTAL CHEMICAL WORK.

The Chemical Division has worked jointly with the Agricultural Division in studying the coefficients of the digestibility of various feeding-stuffs. This division has made the analyses of the fertilizers used, and of the fruit and vegetable products of the Experimental Farm at Southern Pines. It has also made analyses of referees' samples for the Association of Official Agricultural Chemists. Further investigation was made upon the volumetric method for the estimation of phosphoric acid. Investigations are in progress as to the extent of the adulteration of human foods and the adaptability of the soil and climate of the State to the culture of the sugar-beet.

FERTILIZER CONTROL ANALYSES.

On account of the increasing number of brands of the fertilizers licensed for sale in the State, and of the increased consumption of fertilizers in the State, the demands upon this division have considerably increased. The samples of fertilizers are taken under the supervision of the Commissioner of Agriculture and sent to the Station in sealed glass bottles, bearing a number by which the sample is identified. The analyses are completed with all the dispatch consistent with accuracy, and the result reported to the Commissioner. The Commissioner of Agriculture publishes the results at frequent intervals in the Bulletin.

ANALYSES OF SAMPLES FOR THE PUBLIC.

There is no appropriation from any source to provide for the analyses of samples for the public, and this work is not in any sense a part of the regular work of the Station. The Station, however, is very glad, as a matter of courtesy, in this way to serve the public, where the work does not conflict in any way with the regular work of the Station, where the work is of an agricultural character, the results of general interest, and the Station is free to publish the results. During the period embraced by the Report analyses were made of many samples of waters for the Board of Health to test their purity and adaptibility for drinking purposes, of various fertilizing materials, feeding-stuffs, and other miscellaneous samples.

ACKNOWLEDGMENTS.

The Station takes pleasure in acknowledging the receipt of the books and pamphlets, journals and newspapers stated below. The reports and bulletins of the United States Department of Agriculture, and of various Experiment Stations in the different States, Canada and abroad are not included in the list, but are regularly received.

Commissioner of Agriculture, Albany, N. Y. Reports Vol. 1, 2 and 3.

Minnesota Dairy and Food Commissioner, St. Paul. Biennial Report 1895–1896.

Dr. Chas. W. Dabney, Jr., Assistant Secretary of Agriculture, Washington D. C. A National Department of Science.

Prof. H. McCalley, University, Ala. Report on Valley Regions of Alabama.

Dr. J. A. Lintner, State Entomologist, Albany, N. Y. 11th Annual Report.

Prof. A. Williams, New Castle, England. Report on Manurial Trial at New Castle-upon-Tyne, England.

George McKerron, Superintendent Wisconsin Farmers' Institutes, Madison. Bulletin No. 10.

Leland Stanford, Jr. University, California. Contributions to Biology from Hopkins Seaside Laboratory.

American Philosophical Society, Philadelphia, Pa. Proceedings of Society.

Pennsylvania Department of Agriculture, Harrisburg. Bulletins 16 and 17.

Prof. C. Cobb, University of North Carolina, Chapel Hill, N. C. Some Beginnings in Science.

University of Iowa, Iowa City. Laboratory Bulletin No. 1.

American Museum of Natural History, New York City. Vol. 8, 1898.

New York State Board of Health, Albany. Report for 1896.

New York Botanical Garden, New York City. Bulletins Nos. 1 and 2.

Institution for Deaf, Dumb and Blind. Raleigh, N. C. Report for 1894–'96.

Oberlin College, Oberlin, Ohio. Bulletins Nos. 5, 10, 11 and 12.

Smithsonian Institution, Washington, D. C. Report for 1894. Report of National Museum, 1894.

Secretary of Harvard College, Cambridge, Mass. Annals of Astronomical Observatory, Vol. 30, Part 4. Report of Director of Observatory.

Miscellaneous Papers, 1888-1895.

William Wood & Company, New York City. American Fruit Culturist.

Royal Agricultural Society, London, England. Journal of Society, Vol. 8, Part 1.

Department of Interior, Washington, D. C. Eleventh Census. Farms and Homes. Statistics, Vital and Social.

Department of Agriculture, Ontario, Canada. Report for 1895.

California Dairy Bureau, San Francisco. Report for 1895-1896.

Prof. T. Jamieson, Aberdeen, Scotland. Proceedings Agricultural Research Association for 1896.

C. C. Gregg, Superintendent Minnesota Farmers' Institutes, Minneapolis. Report for 1896.

Superintendent of Farmers' Institutes, Ontario, Canada. Report for 1895-'96.

Prof. T. Winter, Bangor, North Wales. Report on Field Experiments, 1895.

Dr. J. P. Hale, Charleston, W. Va. History and Mystery of the Kanawha Valley.

Hon. B. R. Lacy, Raleigh, N. C. North Carolina Bureau of Labor Statistics. Report for 1896.

Society of Natural History, Cincinnati, Ohio. Journal No. 2.

Maine State Board of Health, Augusta. Report for 1896.

California Board of Horticulture, Sacramento. Fifth Biennial Report.

Kansas State Horticultural Society, Topeka. Transactions of Society.

Wisconsin Dairymens' Association, Madison. 25th Annual Report.

Minister of Agriculture, Paris, France. Bulletins 1896.

PAPERS AND JOURNALS OUTSIDE THE STATE.

Agricultural Epitomist	Indianapolis, Ind.
Agricultural Gazette of New South Wales	Sydney, Australia.
Agricultural South	Atlanta, Ga.
American Agriculturist	New York, N. Y.
American Dairyman	New York, N. Y.
American Farmer	Washington, D. C.
American Grange Bulletin and Scientific Farmer	Cincinnati, Ohio.
American Swineherd	Chicago, Ill.
Baltimore Sun (weekly)	Baltimore, Md.
California Cultivator and Poultry Keeper	Los Angeles, Cal.
Elgin Dairy Report	Elgin, Ill.
Farm and Home	Springfield, Mass.
Farm and Home	Melbourne, Australia.
Farm and Fireside	Springfield, Ohio.
Farm, Field and Fireside	Chicago, Ill.
Farm Magazine	Knoxville, Tenn.
Farmers' Advocate	Burlington, Vt.
Farmers' Advocate	London, Ontario.
Farmers' Guide	Huntington, Ind.
Farmers' Home	Dayton, Ohio.
Farmers' Magazine	Springfield, Ill.
Gleanings in Bee Culture	Medina, Ohio.
Hoard's Dairyman	Fort Atkinson, Wis.
Home and Farm	Louisville, Ky.
Homestead	Des Moines, Iowa.
Hospodar	Omaha, Neb.
Indiana Farmer	Indianapolis, Ind.
Industrial American	Lexington, Ky.
Louisiana Planter	New Orleans, La.
Mirror and Farmer	Manchester, N. H.
Montana Fruit Grower	Missoula, Mont.
National Dairyman and Messenger	Kansas City, Mo.
National Stockman and Farmer	Pittsburg, Pa.
New England Florist	Boston, Mass.
Northwest Horticulturist	Tacoma, Wash.
New York Weekly Witness	New York, N. Y.
Ohio Farmer	Cleveland, Ohio.
Practical Farmer	Philadelphia, Pa.

Progressive South	Richmond, Va.
Public Ledger	Philadelphia, Pa.
Rural Californian	Los Angeles, Cal.
Southern Cultivator	Atlanta, Ga.
Southern Farmer	New Orleans, La.
Sugar Beet	Philadelphia, Pa.
Swine Breeders' Journal	Indianapolis, Ind.
The Western Creamery	San Francisco, Cal.
The Wool Record	New York, N. Y.
Tobacco Leaf	New York, N. Y.
Trade Journal	Baltimore, Md.
Wallace Farmer	Ames, Iowa.
Weekly Times	Melbourne, Australia.

PAPERS RECEIVED FROM INSIDE THE STATE.

Alamance Gleaner (Graham).
Asheville Citizen.
Beaufort Herald.
Bulletin North Carolina Board of Health (Raleigh).
Caucasian (Raleigh).
Charlotte Democrat.
Concord Times.
Economist-Falcon (Elizabeth City).
Eastern Reflector.
Free Press (Kinston).
Greensboro Record.
Henderson Gold Leaf.
Hickory Press.
Messenger and Intelligencer (Wadesboro).
Monroe Enquirer.
Morganton Herald.
North Carolina Baptist (Fayetteville).
North Carolina Medical Journal (Wilmington).
Progressive Farmer (Raleigh).
Roanoke News (Weldon).
Salisbury Watchman.
Statesville Landmark.
Sylvan Valley News (Brevard).
Tarboro Southerner.
The Commonwealth (Scotland Neck).
Truckers' Journal (Chadbourn).
Washington Gazette.
Western Sentinel (Winston).
Wilson Mirror.
Wilson Times.
Yankee Settler (Southern Pines).

CONCLUSION.

The work of the past year is completed and speaks for itself. It has been accomplished under somewhat difficult conditions, but with an earnest desire to advance to as great an extent as possible the agricultural interests of the State.

The Acting Director was invited by the Board of Trustees to preside over the affairs of the Station without any knowledge on his part that such action was contemplated. The action, therefore, is all the more complimentary, and the Acting Director is highly appreciative of this distinguished mark of confidence. He also wishes to express his deep sense of obligation to the President of the College upon whose wisdom and counsel he has so largely relied; and to the other members of the Station staff whose co-operation has been given so cordially. He desires further to acknowledge the help received from the previous publications of the Station. These have been freely used in the preparation of this Report.

The reports of the chiefs of the various divisions of the Station are appended hereto as a part of this Report.

Very respectfully,

W. A. WITHERS,
Acting Director.

REPORT OF THE AGRICULTURAL DIVISION.

Acting Director W. A. WITHERS.

SIR: The work of this Division went on to May in harmony with the order which has been previously reported. A pig-feeding experiment, begun in the fall of 1896, was completed early in June, 1897, and the results have been published in Bulletin 143.

The digestion feeding was continued up to August, 1897. There were seven experiments successfully (except one) completed:

Crab-grass hay alone.
Peanut hull and waste. Failure, sheep would *not* eat the material.
Crab-grass hay and cowpea meal, for digestibility of the meal.
Crab-grass hay and corn bran, for digestibility of the bran.
Green rape, in June and July, first cutting.
Green rape in July, second cutting.
Crab-grass hay and rice bran, for digestibility of the bran.

Publications during the year from this Division have been:

Comfortable Low-Cost Barns, Bulletin No. 142; 18 pp.
Feeding Experiments, Milk Records, etc., Bulletin No. 143; 33 pp.
Crimson Clover, Bulletin No. 145; 18 pp.
Miscellaneous Farm Bulletin, Bulletin No. 146; 16 pp.

The correspondence for this year amounts to upward of 750 copy-book pages, and relate mainly to general farming and live stock matters. Some of this matter appears from time to time in *The Bulletin.*

Some time has been spent at the Farmers' Institutes with Commissioner Patterson in the early part of the year, and in the spring and summer with Dr. D. Reid Parker, who was the official representative of the Board of Agriculture in the conduct of Institute work after his election for that purpose by the Board.

In July, 1897, the Agriculturist attended the meeting of the Association of American Agricultural Colleges and Experiment Stations, held in Minneapolis, Minn., representing the Station and College in that body. A partial report of some observations on that trip were made public through *The Bulletin* for October, 1897.

Early in May, 1897, a second test of stock for tuberculosis was conducted. One cow had been quarantined several months previously, and there was some reason to fear the disease had been communicated to other members of the herd.

This was verified by the test, and it was agreed by the Director and Agriculturist that it would be best to slaughter every animal which reacted, the physical condition of which left no doubt of the reaction being due to the disease Tuberculosis.

There were several pregnant animals reserved for tests after parturition.

Dr. D. E. Salmon, Chief of the Bureau of Animal Industry. Washington, D. C., was consulted by letter and requested to send an expert to us for detailed consultation and examinations. Dr. Salmon responded favorably and detailed Dr. A. D. Melvin, who came and examined a number of animals and conducted a post-mortem examination on two cows, which were the most advanced cases. Dr. Melvin advised waiting about four weeks, and then re-testing the herd, when we could decide more accurately which of the cows should be slaughtered. This was done, and six cows condemned. There were two others apparently in good health, but which had reacted. These were noted by Dr. E. E. Terry, who, with Dr. W. C. McMackin, made this test, and conducted the post-mortem examinations, to have been in æstrum when undergoing the test, which may indicate that a re-test might have cleared those heifers, but they were yielding little milk, were fat, and were worth as much for beef then as could be expected from them at any time, if not diseased, so it was decided to include these in the herd to be slaughtered, and then to put these two on the market. The post-mortem examination confirmed Dr. Terry's observation, and no disease could be found.

Evidence of the disease was found in all the cows except the two heifers, and they were both "passed as good for food" by Drs. Terry and McMackin. But sale of these carcasses was forbidden by the City Board of Health officials, on the ground that they came from a diseased herd, and a city statute forbids such. All the animals were deeply buried, with free use of quicklime, and lime was scattered round over the land where the burials were made.

This city ordinance should be repealed and replaced by one more consistent with the public welfare. As it stands it is impossible that it can be reasonably enforced, and in any case like the one detailed above, where animals are rigidly examined and found to be healthy, the carcasses should be used. This would be some encouragement to owners of herds to test out disease, but if the finding of a diseased animal is to be the signal for a boycott of a herd, the diseased ones will *not* be hunted out; or, if found, the facts will be concealed for self interest, and the public will continue blindly to take risks, which no amount of persuasion could induce if presented openly, with dairy products and meats. Thorough inspection of animals and meat is the only safeguard, and the sooner these are recognized and honored, the sooner will the food products on the markets be what they should be—far above suspicion.

To place a herd on this high ground is to make it plain by tests that no disease is harbored in it, and to keep away from it *all* strange cattle until quarantined and tested. Failure in this respect cost the Experiment Station this outbreak of tuberculosis. Since the Station herd was examined and so large a proportion found affected,* the herd at the College has been examined, and although in May, 1897, when the Station herd were examined, this herd was believed to be intact, even more disease was found in it than existed in the Station herd. This herd has been vigorously tested and all diseased animals removed. The grades of low value were all slaughtered (fourteen in number), and the six pure-bred animals, five cows and one bull, quarantined in order to raise healthy calves, which can be done, and the old stock replaced by healthy young ones.

During the fall and early winter some feeding experiments were conducted with cows and heifers in milk. Mr. Johnson did the testing of milk in addition to his teaching. The time of the Agriculturist during the fall term was pretty fully occupied with teaching.

Stock on hand December 31, 1897:

One two-year-old Shorthorn bull, two mature common cows, two Shorthorn heifers, coming three years old, two Shorthorn bulls coming one year old, six heifers just past two years old, and all giving milk, viz.: One grade Polled Angus, two grade Jersey, one grade Shorthorn, one Native, one registered Jersey, three yearling heifers, all grade Shorthorns, one yearling Jersey bull, one six-months-old grade Jersey heifer, two steers coming three years old, four calves as follows: One Jersey (pure bred), three grade Shorthorns; seven driving horses.

Sheep.—Total number, 44, as follows: One Merino ram and three ewes, all registered; one Horned Dorset ram and one ewe, registered; one Southdown ram, no ewes, registered; one Shropshire ram, no ewes, registered; three wethers, used in digestion experiments; thirty-three native and grade ewes.

During 1898 the feeding experiments have been continued. The testing of cows the latter part of 1897 led to post-mortem of one cow and one steer early in January. The heifers now in milk are to be quarantined and subjected to cattle-ticks this summer. These have also reacted, and they can be examined later for tuberculosis, whether they have Texas fever or not.

The manuscript for one Bulletin on Digestion Experiments has been finished and is ready for publication.

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*Six of the eight cows killed were tuberculous, as was one cow retained for a later test; also one steer, two bull calves and several heifer calves, which are under surveilance.

There are a few field experiments under way. There are two plats with cotton, comparison of two varieties; potato varieties: 93 varieties of potatoes are planted, using three rates of seed in nine hills of each variety.

Peanuts—A trial to find if any influence on productiveness can be discovered by planting the meats which are produced within one, two, three or four-celled pods.

Other legumes.—Cowpea: Several varieties from seed grown here and one from L'Ile de la Rennion, with several other interesting members of this family, Soy Bean and Velvet Beans.

The field north of the farm building, which for several years has been in pasture, has been plowed and planted in soiling crops, which it is hoped will prove a practical experiment. The whole field is devoted to this test except the sheep-shed and yards and a plat for the potato experiment.

Hemp is being grown on a small plat.

Corn will be the principal crop for the silo, whilst the cowpea and other plants *must* be cultivated for soiling, recuperating the soil, and for hay.

The terraces now growing rye for seed, and which have a fine crop on them, will be used for forage plats when rye comes off.

A very light crop of *crimson clover hay* has been cut and the crown of the hilltop reserved for seed. The yield is not a third of what might have been expected from the "stand" and area. This is ascribed to the exceedingly dry winter and spring.

Much time has been consumed in teaching this year, and experimental work cannot have the time and attention we have been accustomed to give, hence some experiments well under way fail of results Thus the feeding experiments with cows have been entrusted to the foreman and milker. The student milker has been found capable of doing any convenient thing which suggested itself at the moment, and one needs to be conversant with the facts to give any weight to his words. Therefore, since this man was entrusted with any part of the records the result is worth little or nothing, experimentally.

Improvements needed are, first, and above all, a water supply for the dairy-engine and house. This, it seems, can be had from a spring on the northwest corner of the Experiment Farm. A hydraulic ram can be employed to force up the water at less expense than for a pump and wind-mill.

An underground cool room east of dairy is very much needed for experimental use. That is, to show such a room, get at best construction, and to find what the advantage of the underground room is in amount of reduction of temperature.

Recent additions to stock and tools are:

1 pair of draft horses and harness.
1 clod crusher.
1 hand-power sheep-shearer.

Stock on hand May 1st, 1898, twenty-four cattle as follows:

1 two-year-old Shorthorn bull.
1 aged common cow.
2 two-year-old Shorthorn cows.
6 heifers, two years old and past, as in other reports.
3 heifers, one year old and past, grade, Shorthorns.
1 heifer, one year old, grade, Jersey.
3 cow calves.
1 grade Shorthorn.
2 Shorthorns.
1 grade Shorthorn bull calf.
1 yearling Shorthorn bull.
1 driving horse.
1 work horse.
1 work mare.

Sheep on hand:

4 rams, Merino, Horned Dorset, Southdown, Shropshire.
3 native wethers.
4 ewes registered: One Dorset and three Merinos.
32 breeding native and grade ewes.
25 lambs.

The report of the Poultry Section is given below.

Very respectfully,
FRANK E. EMERY,
Agriculturist.

REPORT OF POULTRY SECTION FOR 1897.

PROF. F. E. EMERY, *Chief of Agricultural Division.*

During the fall of 1896 all yards of fowls were mated as pure breds, and a line of feeding experiments, with grown fowls, artificial hatching and breeding against natural methods, and disease experiments, were outlined for the work of 1897, together with the incidental work as it appeared.

With the burning of my home in April, 1897, all previous records were destroyed, which necessitated another beginning. After corresponding with numerous poultry authorities, the following work was decided upon:

Comparison of breeds for general purpose.
Comparison of breeds for egg production.
Comparative cost of feeding different breeds.
Determining the proper feed for different breeds, amount, etc.

Artificial hatching and brooding vs. natural methods.

Cheap appliances necessary in the poultry yards.

Experiments with diseases and vermin.

Incidental experiments as they are presented and opportunity allows.

Experiments on moulting fowls for exhibition purposes.

It was thought best to begin the year about July 12th, as at that period the moulting season begins with us, i. e. in this climate.

Twelve yards were then mated and monthly records kept of feed given, eggs produced, etc. With the aid furnished by you much valued information as to analysis of different feeds, etc., results have been very gratifying. The health of both old and young fowls has been remarkably good.

The interest by the general public in the Poultry Section has been great, so far as I am able to judge by visitors, both from the immediate vicinity, from different portions of this State and from other States.

Owing to having no experienced aid, the routine of outside work has necessitated my absence from office to such an extent that writing bulletins has been out of the question.

In addition to regular duties the undersigned was called upon to attend several Farmers' Institutes in various counties, to take the photographs of growing crops at Southern Pines, and to judge the Poultry Departments of serveral fairs*. The interest all through the State in better poultry and more of it is large, numerous parties adding pure breeds and discarding mongrels. The report for 1898 will contain a much greater volume of business done, as the loss of the records caused the Division to be put back one season, as after that time it was too late to begin another line of *spring* work. During the year several new yards and houses were built, including a four brooder-house, 27 feet long, with four yards each 10 x 40 feet. The quality of the breeding stock has been much improved.

Respectfully,

F. E. HEGE, *Poultry Manager.*

POULTRY SECTION FOR FIRST HALF OF 1898.

During the first half year January 1st to June 30th, 1898, the principal work of the Poultry Section was done in continuation of the experiments with breeds outlined above. The feeding seemed to develop some differences among the birds in some pens which seemed rather to indicate differences of age and maturity in the same yard and for several yards.

Mr. Hege has not reported on this half year, hence this note.

FRANK E. EMERY, *Agriculturist,*
Chief of Division of Agriculture.

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*Burlington, Oak Grove and Raleigh, and worked up the Asheville Poultry Show, where 1,688 fowls were brought together from eleven States.

REPORT OF THE CHEMICAL AND FERTILIZER CONTROL DIVISIONS.

During the half year ending June 30, 1897, the chemical work was performed under the direction of Dr. H. B. Battle, and is as follows:

*Samples for the Southern Pines Farm.

Fertilizers and fertilizing materials	8	
Irish potatoes, tubers, tops, etc	45	
Grape vine prunings	145	
Sweet potatoes, tubers, vines, etc	62	
Cucumbers, vines, etc	3	
Tomatoes and vines	2	
Cabbage	3	
Beans	20	
Strawberry vines	29	
Corn and corn cobs	40	
		357

Official Samples for the Fertilizer Control.

Fertilizer samples		396

Samples for the Public.

Fertilizing materials	9	
Marls	4	
Agricultural lime	2	
Tobacco	10	
Tobacco dust	1	
Tobacco stems	1	
Miscellaneous fertilizers	7	
Health waters	22	
Mineral waters	16	
Boiler water	1	
Mill sweepings	1	
Peanut meal	1	
Rock	2	
Ores, minerals and rocks identified and values reported	48	
		125
Total for the half year ending June 30, 1897		878

During the year ending June 30, 1898, the following analyses were completed:

Experimental Samples.

For association of official chemists phosphoric samples	7	
For the association of official agricultural chemists nitrogen samples	3	
Fodders and feeding stuffs	34	
Health waters	26	
Tobacco leaves	1	
Irish potatoes	23	
Commercial fertilizers and fertilizing material	13	
Sugar	64	
		171

Official Fertilizer Samples.

Acid phosphates	139	
Acid phosphate with potash	52	
Ammoniated superphosphates	325	
Miscellaneous	39	
		553

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*A large part of the Southern Pines work was done during the summer and fall of 1896, but the analyses were not completed until after January 1st, 1897.

SAMPLES FOR THE PUBLIC.

Health waters	109	
Mineral waters	37	
Phosphatic lime	1	
Lime	1	
Cotton-seed meal	3	
Commercial fertilizers	10	
Marl	10	
Ashes	1	
Deposit from pump	1	
Fire clay	2	
Brick clay	4	
Boiler scale	1	
Worm dust	1	
Cider	1	
Bran	1	
Fish scrap	1	
Identifications of minerals, ores, etc	88	
		271
Total for the year ending June 30, 1898		995

The principle lines of work of this Division are as follows:

The Southern Pines Work.—This consists of the analysis of the fertilizing materials used on the Experiment Farm, together with analysis of the various products of the farm, with a view to ascertain the exact amount of fertilizers added to the different crops, the amount removed by them and the effects of the various fertilizers.

Digestion Experiments.—This work is carried on in conjunction with the Agricultural Division. This series of experiments was begun some years ago by the Chemical Division, through Mr. Kilgore, former Assistant Chemist, and the Agriculturist, Professor Emery.

Health Analysis of Waters.—This Division has instituted, and is now carrying on some experiments with a view to ascertaining some of the of the sources of error in the health analysis of water.

Experiments with Sugar Beets.—During the spring of 1898, at the request of the Secretary of Agriculture, communicated through the Chemist of the Department, the Experiment Station distributed a large quantity of sugar-beet seeds, with a view to ascertain if the conditions in the State were favorable to the growth of the beet. In addition to the seeds received through the Secretary, a large quantity was received from the German Kali Works. Previous experiments have been made by the Station along this line.

Work for the Association of Official Agricultural Chemists.—This Division has co-operated each year with the Association of Official Agricultural Chemists, in making the analysis of some of the samples sent out by the referees, with a view to testing methods and improvements suggested. Mr. Kilgore, previously an assistant in this Division, proposed a method for the volume estimation of phosphoric acid.

Extent of Food Adulteration.—The General Assembly of 1895 enacted a law making the adulteration or misbranding of articles of food a misdemeanor, and prescribed a penalty for the same, but no one was charged with the duty of executing the law. This Division has undertaken an investigation as to the extent to which adulteration is practiced with some of the more common articles of food, such as sugar, coffee, tea, flour, baking-powders and vinegar. The samples were purchased in the open market.

Analyses for the Fertilizer Control.—There is an increasing number of brands of fertilizer registered for sale in North Carolina each year and in consequence there is an increasing demand upon this Division. During the past year and a half analyses were made of 949 samples, taken under the direction of the Commissioner of Agriculture by the official inspectors from lots on sale in the State. Analyses of some of the samples were made in duplicate. This Division realizes the importance of this work to the farmers of the State and endeavors to complete the analyses with as great rapidity, and accuracy as care will permit.

Analyses for the Public.—No appropriation is made by the State providing for analyses by this Station of samples for the public. The Station is very glad, however, to do this work as a matter of courtesy, where it does not intefere with the regular work of the Station, where it is of an agricultural character, where the Station's directions are followed in regard to the sending the samples, and where the Station is free to publish the results. During the past year and a half, analyses were made of 366 samples for the public, 131 being drinking waters, with a view to ascertaining if they were suitable for drinking purposes. The remaining samples consist of fertilizer materials and other miscellaneous samples.

Very respectfully,

W. A. WITHERS, *Chemist.*

REPORT OF THE DIVISIONS OF HORTICULTURE, BOTANY AND ENTOMOLOGY.

PROF. W. A. WITHERS, *Acting Director.*

I herewith present the report for these Divisions of the Station for the past year and a half.

HORTICULTURE.

The Horticultural work of the Station has mainly been carried on at Southern Pines, in connection with the Committee in charge of the experimental work done in connection with the State Horticultural Society and the German Kali Works. The practical supervision of the work for this Committee* has been placed in the hands of Mr. Rhodes and myself, by the action of the Committee, and the sub-position of Horticulturist to this Committee has been assigned to me. Heretofore this work has fallen to me simply as ex-officio to my duties as Station Horticulturist, and has been regarded as the Horticultural department of the Station, as experimental work at Raleigh was necessarily abandoned to a great extent by the removal of Mr. Rhodes, my personal assistant, to Southern Pines, and his appointment as Resident Superintendent for the Committee. With my assistant at Southern Pines, it was necessary that all of the Horticultural work should be concentrated there. Hence, for the purposes of this work, outside the work for the Supervising Committee, it was necessary that land should be provided for my purposes as Station Horticulturist alone. This was accomplished by the former Director leasing another piece of land adjoining that of the Committee, to be under the sole management of the Station Horticulturist for experimental work in general. On this land I have begun, in connection with the Forestry Division of the Department of Agriculture at Washington, a series of experiments in the growth of forest trees from seed collected in the various states entering into the experiment. The object of these experiments is to determine the differences in the same species of trees from seeds collected in different latitudes and climates. Seeds of the same species are sent to us which are collected in states from Iowa and Nebraska to Florida, and the same seeds are collected here and sent to the other States engaged in the work. The scheme has not been fully carried out by reason of the difficulty in getting seeds of all the the trees every year in all the States. Failure of the seed crop here resulted in no seeds being collected in North Carolina last year. I have, however, received seed from several states, and the plants grown a year ago from the various seed samples have been transplanted and studied. It is proposed to carry on this work for a number of years.

Bulb Culture.—There has been, for some years past, a growing interest in the capacity of our soil and climate for the production of the various bulbs used so extensively by our florists in the forcing of winter flowers. Experiments which I have been conducting for several years have demonstrated that we can produce here, to great perfection, many bulbs that are now imported from Europe. Few people who are not familiar with the trade in these things, realize its magnitude, and the enormous amount of money sent abroad annually for their purchase, most of which might be kept at home with profit to our growers. The fine quality of the bulbs I have shown in New York attracted the attention of the importers and dealers in these things, and all of them declare that they had rather come to North Carolina for their supplies than go to France, Holland and Italy for them. Additional attention has lately been drawn to this matter by the failure of the lily crop of a certain kind grown in Bermuda and Japan, from a serious disease which renders the bulbs worthless for forcing. The Department at Washington lately sent a special agent, Mr. M. G. Kains, to confer with me, and to visit the section of the State where other bulbs have been grown, so that a report on the subject could be made up and published. The point to be decided is whether we can, in this climate, ripen the Bermuda lily early enough for the early forcing in autumn, and whether we can succeed in growing the bulbs clear of the disease. I have commenced to experiment with this lily and hope to continue it, with the aid of bulbs sent by the Department, and have some confidence in a favorable result, as the bulbs already grown seem to be more healthy, and to ripen early enough. With another lily, the Lilium Candidum, which is also used largely for Easter forcing, we have demonstrated that we can produce them much superior to those imported from France, and there has been no difficulty in selling at a remunerative price all that we have grown in a small way, and the demand for these is such that we could, this season, have sold a million if we had had them, as the dealers North are competing with each other for our Lilium Candidum bulbs. The chief difficulty here in the way of the development of the bulb industry, aside from a lack of experience and skill, is the lack of means among the growers. Most of these bulbs are different from the tuberose, which has been so largely grown in the eastern section of the State, in the fact that it takes from three to five years to get a marketable crop, and the first investment for stock does not give any return until the product is made. Hence inexperienced men hesitate to invest. Of course, after the business is well under way, there would be an annual crop, but at first there must be a considerable outlay for stock and a period of waiting for results, with constant expenditure for labor and caring for the product. In the culture of the tuberose, the growers plant the sets in the spring and harvest the crop the same autumn, but this cannot be done with lilies and hyacinths. If it can be once demonstrated that there is a large profit in growing bulbs on a commercial scale, and men who understand the work are gotten through the State, the dealers in the Northern cities will be ready to furnish the stock and wait for returns. But they need be assured that the returns will be at hand, and hence the necessity for skilled men. I would gladly go among the growers and instruct them in the management of the bulbs, if means are at hand for the purpose and the work is undertaken on a scale to warrant it. I have never yet had means enough at my disposal or land for the purpose, to fully test the matter on a commercial scale. It is evident that the soil at Raleigh is better suited to these things than that at Southern Pines, and the work hereafter will be done here.

Melons.—I regret that the experiment with a great variety of melons sent by the Department at Washington, proved a total failure at Southern Pines, owing to the peculiarity of the season, which at first was so dry that in that sandy soil many died outright and the remainder were damaged by the heavy scalding rains that succeeded the drought after the fruit had formed. As these seeds were collected in a new region of Central Asia, we were in hopes of getting some of value from the lot. If seed can be had again the experiment will be repeated at Raleigh under more favorable conditions.

Co-operative Work at Southern Pines.—The extensive series of experiments inaugurated by the committee at Southern Pines have been conducted with zeal and fidelity by my assistant, Mr. Rhodes, who by training and experience is well fitted for the work But as this work will be specially reported on by the Committee, there is no need for further notice of it here.

Forcing of Vegetables.—During the two winters past we have experimented to some extent in the culture of tomatoes, under glass, as a winter crop. Enough has been shown by these experiments to prove that the forcing of vegetables under glass, in heated glass structures, can be made more profitable here than in the North, where it is being so largely and profitably practiced. Our abounding sunshine even, in our coldest winter weather, gives us a great advantage, and the smaller consumption of coal should give a wider margin of profit here than in the North. I have in preparation a bulletin on the use of glass in market-gardening, which I hope to have out shortly. There has been of late a great deal of interest manifested in the winter crop of lettuce grown for the Northern markets in the eastern part of the State. Most of the growers still use for this crop frames covered with cotton cloth, which is at best a poor substitute for glass. I have tried to convince them that glass is far better and in the long run cheaper than cloth, and there is a disposition to try the glass. When they once begin to use glass and become skillful in its handling, the transition from a cold frame covered with glass sashes to a heated greenhouse is easy, and the future success of market gardening in Eastern North Carolina depends largely on the use of glass, just as the competition of the far South has compelled the northern growers to make a greater use of glass, and thus to furnish better products and sell them at better rates than the products from the open ground in Florida. I have sold tomatoes here in direct competition with those from Florida for double the price of the Florida product, by reason of the superior quality of those grown under glass.

BOTANICAL.

During the coming summer the Herbarium of the Station will be enriched by a collection of native plants both from the section around Raleigh and from the mountain section of the State, where my Assistant, Mr. C. W. Hyams, will spend his vacation in making collections. He has been getting together a very large collection of fungi, both edible and poisonous, which it is proposed to exhibit permanently in preservative fluids. These collections will be of great use in the identification of specimens sent to us, and for exchange with other collections, so that from the duplicate plants collected we can enrich the Herbarium with the species of other states by exchange with collectors. Mr. Hyams has also prepared and published a bulletin containing a list of the plants that have been collected and sold in this state for medicinal purposes, and this has been highly commended. We have during the year made numerous identifications of plants and grasses from correspondents in all parts of the State, and there seems to be a greater interest in the native grasses, many of which can be cultivated with profit. The Velvet Bean, which has been much talked about as a forage plant in the far South, has been tested here, and it seems evident that it will succeed here, and in a favorable season will ripen a fair crop if planted not later than the last of April. Whether it will compete here with the cowpea as a forage plant seems doubtful, as it takes too long a season, and cannot be used as the cowpea can for sowing after a small grain crop has been harvested. But from the mass of foliage it makes on poor land, it is evident that it will be of use as a means of getting vegetable matter into a worn soil.

ENTOMOLOGICAL.

At the meeting of the Board of Trustees last summer, they saw fit to assign to me the work formerly done by the Entomologist. This work included the work of inspection of nurseries for the Commission for Controlling Crop Pests established under the law enacted for the suppression of the San Jose scale and other dangerous insect pests. I attempted to do this work in the fall of 1897, but finding it required my being absent from Station and College work too long, I was obliged to give up this part of the work. As it was, I spent over two months at it, without any extra pay, though the Entomologist had formerly been paid a salary of $1,500 per annum for the Entomological work alone. The great interest that has been excited over the spread of the San Jose scale has caused people throughout the state to look more closely after their trees, and I have had numerous letters with specimens for identification, all of which have been answered. A scale insect more widely scattered in the state than the San Jose scale, and while less rapid in the destruction it causes, is equally certain to destroy trees, is the Mytilaspis Pomorum—the apple tree bark louse. This insect I found prevailing to an alarming extent in all the best apple sections of the state in the upper Piedmont and mountains beyond the Blue Ridge. The hard scale which invests this insect renders its destruction by spraying difficult, and the only time when it can be killed by spraying to any advantage is when the young insects are coming out in spring. This scale will cause serious losses in Western North Carolina if not checked. The San Jose scale is almost entirely confined to the Eastern part of the State, and is most prevalent about Southern Pines, Tarboro and a few other points in smaller numbers. The gloomy scale was found very abundant on soft maple trees at Durham, but it seems to have succumbed to the fungus disease introduced from Florida, and the trees when last seen were clear of live insects. Lecanium Persicum was found on one orchard of plums at Southern Pines. This is one of the soft scales, and is more readily subdued by whale-oil soap spraying than some of the other scales. In certain cases the spraying with pure kerosene has been found efficient for the destruction of the San Jose scale, but in other instances the spraying has killed the trees. While a spraying that amounts to a mere, but complete, atomizing may not kill the tree, it is evident that careless work and the use of an overquantity of the oil will do serious harm, and while not always killing, may check the growth and the perfection of the fruit for the season. The old gardners' remedy for all scale insects has long been the solution of whale-oil soap, and it is probable among all the spraying materials recommended there is still none better than this. The use of Hydrocyanic gas is too troublesome, dangerous and expensive for general use, and is more applicable to trees dug and housed for shipment than to those in the open ground. It seems probable that while a strict application of the law preventing infested stock from coming into the state may keep more infection out, the fruit-growers of the state have to make up their minds to keep a constant war against all sorts of insects, and the San Jose scale can be held in check. More is to be hoped for from the spread of the fungus disease, which has so reduced the scale in Florida, and which has been shown to thrive here, than from any spraying by individuals while the neighborhood remains infected. Perpetual vigilance is really the price of fruit in the future, and the advent of the San Jose scale only adds another to the forms we have to fight.

All of which is respectfully submitted.

W. F. MASSEY,
Horticulturist, Botanist and Entomologist.

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION
IN ACCOUNT WITH
THE UNITED STATES APPROPRIATION.

1897.			*Dr.*
	To receipts from the Treasurer of the United States as per appropriation for fiscal year ending June 30, 1897, as per Act of Congress approved March 2, 1887		$15,000 00
		Cr.	
June 30.	By salaries	$5,255 13	
	labor	1,411 00	
	publications	2,751 10	
	postage and stationery	759 60	
	freight and express	389 38	
	heat, light and water	374 16	
	chemical supplies	501 23	
	seeds, plants and sundry supplies	546 49	
	fertilizers	20 35	
	feeding-stuffs	826 97	
	library	188 33	
	tools, implements and machinery	203 05	
	furniture and fixtures	139 28	
	scientific apparatus	286 70	
	live stock	32 30	
	traveling expenses	383 83	
	contingent expenses	231 10	
	building and repairs	700 00	
	Total		$15,000 00

I, the undersigned, duly appointed Auditor of the corporation, do hereby certify that I have examined the books and accounts of the North Carolina Agricultural Experiment Station for the fiscal year, ending June 30, 1897; that I have found the same well kept and classified as above, and that the receipts for the year from the Treasurer of the United States are shown to have been $15,000, and the corresponding disbursements $15,000; for all of which proper vouchers are on file and have been by me examined and found correct.

And I further certify that the expenditures have been solely for the purposes set forth in the Act of Congress approved March 2, 1887.

(Signed) T. K. BRUNER, *Auditor.*

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

IN ACCOUNT WITH

THE UNITED STATES APPROPRIATION.

1898.			*Dr.*
	To receipts from the Treasurer of the United States as per appropriation for fiscal year, ending June 30, 1898, as per Act of Congress approved March 2, 1887		$15,000 00
		Cr.	
June 30.	By salaries	$9,039 96	
	labor	1,151 11	
	publications	1,427 61	
	postage and stationery	669 63	
	freight and express	161 40	
	heat, light and water	6 00	
	chemical supplies	379 86	
	seeds, plants and sundry supplies	93 72	
	fertilizers	7 44	
	feeding stuffs	1,028 17	
	library	145 49	
	tools, implements and machinery	130 66	
	furniture and fixtures	89 92	
	scientific apparatus	5 63	
	live stock	486 45	
	traveling expenses	118 90	
	contingent expenses		
	building and repairs	58 05	
	Total		$15,000 00

I, the undersigned, duly appointed Auditor of the corporation, do hereby certify that I have examined the books and accounts of the North Carolina Agricultural Experiment Station for the fiscal year ending June 30, 1898; that I have found the same well kept and classified as above, and that the receipts for the year from the Treasurer of the United States are shown to have been $15,000, and the corresponding disbursements $15,000; for all of which proper vouchers are on file and have been by me examined and found correct.

And I further certify that the expenditures have been solely for the purposes set forth in the Act of Congress approved March 2, 1887.

(Signed) J. R. CHAMBERLAIN, *Auditor.*

RECENT BULLETINS.

The following are some of the recent Bulletins of the Experiment Station:

No. 70. Weed Pests of the Farm; Japan clover, cuts 11, pp. 28.
No. 71. Co-operative Field Tests During 1889; Hill-side Ditches, cut 1, pp. 32.
No. 72. Work in Horticulture; Pea-vine Manuring, pp. 16.
No. 73. The best Agricultural Grasses; plates 74, pp. 100.
No. 75. Fertilizer Analyses; season of 1891, pp. 16.
No. 77. Value of Pea-vine Manuring for Wheat, plate 1, pp. 8.
No. 78. Some Injurious Insects, plates 37 pp. 32.
No. 79. Facts for Farmers, in Plain Language for Farmers' Reading, pp. 24.
No. 80. Silos and Ensilage, pp. 17.
No. 81. Feeding Cotton-seed Hulls and Meal for the Production of Beef, pp. 28.
No. 82. Fertilizer analyses and the Fertilizer Control for 1891, pp. 20.
No. 83. Growing Celery in the South; Cultivation of Onions; Notes of Horticultural Work During 1891, cuts 2. pp. 20.
No. 84. Some Enemies of Truck and Garden Crops, cuts 32, pp. 26.
No. 85. The Late Crop of Irish Potatoes in the South, pp. 10.
No. 86. Tobacco Curing by the Leaf Cure on Wire, and the Stalk Processes, pp. 32.
No. 87. All Publications of the Station, from March, 1877, to September, 1892, pp. 20.
No. 88. Fertilizer Analyses and the Fertilizer Control During 1892, pp. 24.
No. 89. Co-operative Field Tests During 1891 and 1892, pp 48.
No. 90. Practical Stock Feeding, pp. 32.
No. 91. Some Experiments in Wheat Culture. pp. 20.
No. 93. Feeding Experiments, pp. 48.
No. 94. Horticultural Tests and Results with Vegetables, Fruits and Bulb Culture, pp. 20.
No. 95. The Fertilizer Control During 1893, pp. 32.
No. 96. Miscelleaneous Agricultural Topics, Cuts 19, pp. 32.
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No. 150. Medicinal Plants of North Carolina, pp. 84.
No. 151. The Fertilizer Control for 1897, pp. 12.

Any of the above will be sent cheerfully upon application by Postal Card to the Director of the N. C. Agricultural Experiment Station, Raleigh, N. C.

Fertilizer Analyses of the Fertilizer Control

INCLUDING OFFICIAL ANALYSES OF SPRING AND FALL SAMPLES OF 1896

ISSUED BY THE
NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION
RALEIGH, N. C.

BULLETIN No. 136

JANUARY 12, 1897

Publications will be sent to any address in North Carolina upon application.

N. C. COLLEGE OF AGRICULTURE AND MECHANIC ARTS.

THE NORTH CAROLINA

AGRICULTURAL EXPERIMENT STATION

AND

THE FERTILIZER CONTROL STATION

UNDER THE CONTROL OF THE

N. C. STATE BOARD OF AGRICULTURE.

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RALEIGH, N. C

FERTILIZER ANALYSES OF THE FERTILIZER CONTROL

INCLUDING

OFFICIAL ANALYSES OF SPRING AND FALL SAMPLES OF 1896.

BY H. B. BATTLE, DIRECTOR.

As has has been frequently stated, the work of the Station lies under two heads:

1. The Agricultural Experiment Station.
2. The Fertilizer Control Station.

THE FERTILIZER CONTROL STATION.

The present bulletin is issued in the interest of the latter, and presents to the people of the State the analyses of samples of fertilizers taken both in the spring and fall seasons of 1896. It is issued before the opening of the spring season of 1897, in order to give the relative standing of all brands of fertilizers sold in the State, so far as they have been found and sampled. This bulletin is published before the movement in fertilizers has begun for 1897, with a view of affording to purchasers means of judging of the standing of any given brand during the past season.

Analyses for 1897. As is known, the samples of fertilizers are taken by the official inspectors from fertilizers after they have been sent into the State, and are out of the hands of the manufacturers and in the hands of local dealers. These samples, therefore, represent exactly what the purchasers are getting. Samples are taken throughout the season by the different inspectors in various portions of the State. Analyses are made very promptly upon receipt of samples from inspectors, and prepared for publication with the least possible delay. As in past years, they will be printed every two weeks during the fertilizer season of 1897. These bi-weekly bulletins are sent only to those who request them, but one application only is required for the entire season.

The present Fertilizer Laws. The following carefully prepared digest shows accurately, in small compass, the existing laws in regard to fertilizers. It is intended to give information in regard to the fertilizer trade which should be known by purchasers, dealers, and the public generally.

No manipulated guanos, superphosphates, commercial fertilizers or other fertilizing material shall be sold or offered for sale unless a tonnage charge of twenty-five cents per ton has been paid. Each barrel, package or bag shall have attached a tag representing this fact, which tag shall be issued by the Commissioner of Agriculture according to regulations prescribed by the Department of Agriculture. The Department of Agriculture has power at all times to have samples collected of any fertilizer or fertilizing material on sale, which must be taken from at least ten per cent of the lot selected. These samples are taken from the goods in the hands of dealers after they are shipped from the manufactories, and accordingly represent the true grade of fertilizers offered for sale.

Every package of fertilizer offered for sale must have thereon a plainly printed label, a copy of which must be filed with the Commissioner of Agriculture, together with a true sample of the fertilizer which it is proposed to sell, at or before the shipment of such fertilizer into the State, and which label must be uniformly used and not changed during the year. This label must set forth the name, location and trade-mark of the manufacturer; also the chemical composition of contents and real percentage of the ordinary ingredients claimed to be present, together with date of analyzation, and that all charges have been paid. There must be no variation in the guaranteed percentages, but the bags must be branded with the exact chemical composition of the contents No fertilizer can be sold with a content less than eight per cent. of available phosphoric acid, two per cent ammonia, and one per cent. of potash. Cotton-seed meal is exempted from paying the tonnage charge; also land plaster, agricultural lime, oyster-shell lime, marl, and bulk materials for manufacturing purposes, upon which a tonnage charge is to be paid thereafter.

It is a misdemeanor, and a fine of ten dollars for each bag, for an agent or dealer to offer for sale any such fertilizer or fertilizing materials not properly tagged, or a consumer to remove it, or a railroad agent to deliver it. Any fertilizer or fertilizing material that does not contain the ingredients as represented by the label is liable to seizure, and, after being established on trial, its value is recovered by the Board of Agriculture Any person who offers for sale fertilizers or fertilizing material without having attached thereto labels as provided by law, is liable to a fine of ten dollars for each separate package—one-half, less the cost, going to the party suing, and the remainder to the Department; and if such fertilizer is condemned, the Department makes analyses of the same and has printed labels placed on each package, giving the true chemical ingredients of the same, and fixes the commercial value at which it may be sold. The Department of Agriculture can require agents of railroads and steamboat companies to furnish monthly statements of the quantity of fertilizers transported by them. The Experiment Station analyzes samples of fertilizers taken by the official inspectors, and publishes the same whenever needful.

WHEN ANALYSES OF FERTILIZERS ARE MADE FOR FARMERS.

The Station does not analyze samples of fertilizers for manufacturers or dealers. It discontinued the practice some years ago, taking this action for several reasons. When the fertilizer manufacturing industry was in its infancy in North Carolina, the Station aided them in every laudable way by advice as to formulas, ingredients suitable for mixing, and by making analyses of materials for them. Now the industry has so grown that sufficient knowledge and facilities are at hand to render it unnecessary to continue the assistance formerly so freely given. Another reason why this has been withdrawn is that it was found that there was a tendency to abuse the privilege, and occasionally samples were sent to the Station and analyzed that did not truly represent the materials sold. In this particular case, use was made of the Station's analysis in what might have been an unlawful purpose.

Analyses are still made for farmers, to aid them in preventing fraud in their purchases of fertilizers; and this applies also to fertilizing ingredients, such as kainit, cotton-seed meal, chemicals, and the like. These analyses are made upon the following conditions:

1. That the article to be sampled has regularly paid the tonnage charges for inspection. This charge is extremely small in itself, and was instituted for the protection of farmers and others purchasing these materials, and enables the fertilizer inspection and control to be sustained. Millions of dollars have been saved over and over again by reason of the operations of this control and the continual careful oversight of the fertilizer trade. This protection cannot be extended to fertilizers that have not the requisite tags attached to the bags. It is unlawful for dealers to sell bags or any packages of fertilizers not properly tagged, as well as for shipping agents to deliver and consumers to remove them. Such being the case, the very fact that these materials are not tagged would indicate that they were unlawfully on the market, and farmers are advised to refuse to deal in such materials.

2. There must be some special reason for thinking the grade below the guarantee. This requirement is necessary, as otherwise the Station would receive so many samples that the analyses of the official samples might be very greatly retarded thereby if all analyses were attempted at the time they were received. The official inspectors are constantly travelling over the State during the fertilizer seasons and they draw samples wherever fertilizers are found. It is preferable that the samples should be drawn by them in the usual operations of the fertilizer control, for they have better facilities and are more thoroughly acquainted with the proper manner of taking them. On account of their official character, analyses of such samples are of far more importance in disputed cases than a sample from a private party. The Station prefers, therefore, that samples should always come through the official inspectors. Nevertheless, where there is some special reason for doubting the purity of a lot of fertilizers, it will make an analysis of a sample if all of the conditions that are named have been observed.

3. The sample must be taken according to forms prescribed by the Station, which can be obtained upon application. This is necessary in order to procure as fair and average a sample as is possible. It can be easily seen that upon the sample depends entirely the value of the analysis. If it is taken carelessly it may not represent the materials on sale, and the analysis may be entirely worthless on account of that fact. After the sample is received the Station can have no means of ascertaining by an examination of it whether it has been accurately taken or not. It must, therefore, rely for their accuracy solely on the instructions it gives in advance for drawing these samples. In order to be positive as to the sample none should be sent coming from a manufacturer or dealer. It should always be drawn under the personal supervision of the sender. The sampling in every case must be witnessed and signed by two witnesses, stating

that all the instructions have been complied with and a fair average sample has been secured, representing in their opinion the lot in question. If it is desired by the sender, the name of the brand and manufacturer, with the guaranteed percentages, may be retained until after the analysis is received by him, but in every case these must be returned to the Station for completion of the records concerning the sample. As a rule there must be at least three tons in the lot to be sampled, though in special cases exceptions are made.

The Necessity for Accurate Sampling.

Owing to the nature of the ingredients composing a fertilizer, it often happens that these ingredients do not remain thoroughly mixed. This is caused by the transportation and handling of the bag, whereby the fine and heavy particles (generally of phosphate) separate from the lighter and more bulky portions of organic materials furnishing nitrogen (or ammonia) and potash, such as cottonseed meal and tobacco stems. The heavy particles, which are at the same time finer, have the tendency to settle towards the bottom, thereby leaving the coarse organic materials at the top. If now a sample be taken from the top of the bag only it will show by analysis a higher percentage of the nitrogen or potash than would be the case if the whole contents were carefully mixed before the sample was taken. The analysis will also show a lower percentage of phosphoric acid than should be, because a portion of the fine phosphate has already settled towards the bottom, and is not reached in the sampling. The official inspectors obviate this difficulty by the use of a long, hollow steel sampling tube, which is thrust in from side to side or end to end of the bag. It is then withdrawn, bringing out a core of the contents of the bag in the same position as occurring inside. The instructions for sampling, as given by the Station, suggests a plan for securing an average sample without the use of this sampling-tube.

THE NEED OF FERTILIZER ANALYSES, AND AN EXPLANATION OF TERMS USED.

The analysis of a fertilizer is made to determine the quantity of each valuable constituent present. No one, by looking at a fertilizer, can tell its grade, and whether the constituents claimed by the manufacturers are really present. This must be done by a careful chemical examination, and this can only be accomplished by competent experts. Anterior to 1877, before the establishment of the Fertilizer Control, there being no restraint upon manufacturers, many fertilizers were of little value, and farmers were losing enormous sums annually, with no opportunity of ascertaining the real character of the goods they were buying. The result in the field was oftentimes disastrous, and the planter lost not only the actual amount paid for the fertilizer, but also the prospective yield in his crop. Now this is changed. By the operations of the Fertilizer Control there is no opportunity for the lowest grades of fertilizers to be brought into the State, unless fraudulently. All brands proposed to be put on sale have to be first registered with the actual guaranteed percentages before they can be lawfully sold. Low grade fertilizers are excluded by law. Samples are taken of the goods after they are put on the market, analyzed and published broadcast. If the grade is found to fall materially below the guarantee, it is subject to seizure and condemnation. Whenever the grade is deficient, but not materially so to cause condemnation, the analysis is printed so that the public may be warned in the future.

Terms Used in an Analysis.

All figures given in the tables, except the value per ton, are stated in per cents or parts per 100. There are three special constituents which, when present, give a fertilizer its value. These are phosphoric acid, nitrogen (or ammonia) and potash. The valuable chemical elements in these constituents are phosphorous, nitrogen and potassium respectively. These constituents are never present as such, but always combined with other compounds, which combination is necessary for their existence in the fertilizer. In fact, these terms so often seen, phosphoric acid, nitrogen (or ammonia) and potash, refer to chemical compounds which do not exist as such, and are only used as a convenient method of referring to the ingredients present in a fertilizer and their amounts.

Phosphoric Acid. In what combinations these three ingredients above stated occur, depend entirely upon the materials used. If the phosphoric acid is derived from the phosphates of fossil origin (South Carolina rock, etc.), as is most often the case, the phosphorus present in them is combined with lime in the form of tri-calcium phosphate, or three parts of lime in combination with phosphoric acid. As this is very insoluble in the soil and is not readily taken up by plants, it is treated with sulphuric acid to render it more soluble and available. After this treatment the phosphate contains only one part of lime and more phosphoric acid than before. It is possible for some of the soluble phosphate so made to slowly change back to the original form, but before reaching it an intermediate form may result with more lime than the soluble. This intermediate form is called the *reverted* phosphate, and the quantity present is estimated as so much *reverted phosphoric acid.* In the laboratory estimation, the soluble phosphoric acid is all that is soluble in pure cold water; the reverted phosphoric acid is that soluble in a solution of ammonium citrate, according to a standard method of analysis, but insoluble in water; and, lastly, the insoluble phosphoric acid is that which is insoluble both in water as well as in the citrate solution.

The total phosphoric acid present in a fertilizer or fertilizing ingredient is consequently made up of three forms: (1) soluble phosphoric acid, (2) reverted phosphoric acid, and (3) insoluble phosphoric acid. The last form is not considered as available to the plants as are the other two forms. The first two forms combined are often spoken of as *available phosphoric acid*, and is not a distinct form of phosphoric acid, but is only the collective name of the reverted and soluble forms taken together. The available phosphoric acid is consequently the sum of the soluble and the reverted, or is the difference between the insoluble and the total phosphoric acid. The available phosphoric acid is now valued at 4 cents per pound, according to the plan explained further on. Equal values are there given to the soluble and reverted forms. It is likely that the Station may separate these forms in the near future and accord to the reverted a lower valuation than to the soluble phosphoric acid. The insoluble phosphoric acid is not valued, except in the case of pure bone meal, when a valuation of 3 cents per pound is given to it. This will probably be changed to embrace a range of values according to the fineness of the meal.

Nitrogen (*or Ammonia*). Nitrogen should always be used to represent compounds of this character. Ammonia is somewhat misleading, for in many cases of organic materials ammonia is not present at all, but nitrogen is present in the form of nitrogenous matters and would be a better basis of value. Ammonia, however, has become to be used so exclusively by the trade to represent these materials that the term cannot now well be dropped. Consequently both nitrogen and ammonia are given. The former is converted to ammonia by multiplying by 1.214. Onlv nitrogen (ammonia) from the well recognized legitimate sources is valued. Others which are considered as adulterations are not valued. The value given to the former is now 12 cents per pound.

Potash. This constituent does not exist as such, but combined as sulphate, muriate (chloride), carbonate, nitrate, or in organic combination. The potash estimated is that soluble in pure cold water and is valued at 5 cents per pound.

Water. The quantity of moisture present is estimated as a matter of interest to give an indication of the property of the fertilizer, whether dry or wet. It is not used in estimating the commercial value.

Guaranteed Percentages. The percentages guaranteed by the manufacturer are given side by side with the percentages of the various constituents as found by analysis. This facilitates comparison. The commercial value as determined by these guarantees, and the same valuation of constituents as are applied in the analysis, are given in the tables side by side with the commercial value as determined by the analysis.

Mechanical Condition. As a fertilizer in a fine state of subdivision is of more value than a coarse one, because it is more available to the plants in the soil, the mechanical condition of each fertilizer, as it is received from the inspector, is stated. In the same way a dry fertilizer is more easily handled and distributed than a damp or moist one, and is consequently of greater value. The plan for designating the mechanical condition is as follows: *n*—fine, *d*—good, *r*—fair, *s*—coarse, *b*—very coarse, *p*—damp, *y*—lumpy, and *w*—wet.

Relative Seaboard Value per Ton of Unmixed Ingredients. For the purpose of a better comparison among the various brands, and to give some idea of their worth, the relative seaboard value of the unmixed ingredients per ton are given as determined by the analysis. In the next column is also given, calculated in a similar way, the value of the guaranteed amounts of the constituents. A fuller discussion upon these relative commercial values, how they are calculated, and in what way they are useful, will be found in the two following sections.

How the Valuations of Constituents are Determined.

The valuations of the three constituents, available phosphoric acid, ammonia, and potash, are intended to give the market price for cash at the seaboard of the ingredients making up a fertilizer. The cash price for small lots in bags, free on board cars, are intended. These valuations are made up early in January of each year, to run through the spring and fall seasons. It is expected that there will be variations in the market price of the ingredients during the course of the year, but experience has shown that this variation will be slight. This is because fertilizing materials are largely contracted for in advance before the opening of the year, and in many cases a large majority of the fertilizers are already manipulated before the beginning of the season.

The valuation of the constituents are fixed by a careful examination of existing conditions of the trade, the markets at important centres, and from actual quotations given by seaboard manufacturers and dealers upon the various ingredients used for manipulating fertilizers. These quotations are for cash in small lots of five tons and less, free on board and bagged.

The valuations for the year 1897 have been fixed at the following rates:

For available phosphoric acid	4	cents per pound.
For ammonia	12	" "
For potash	5	" "

The analyses hereafter given in this bulletin are calculated at the above rate, which rate will be retained during the coming year, and published in the bi-weekly analyses of fertilizers already mentioned.

During the past year (1896) available phosphoric acid was valued at 4½ cents per pound, ammonia at 13 cents, and potash at 5 cents. Consequently the valuations for the present year (1897) are reduced by ½ cent per pound for available phosphoric acid, and 1 cent per pound for ammonia, the potash remaining the same. The reduction in phosphoric acid and ammonia is brought about by lower ruling rates of ingredients furnishing these materials.

How Values per ton are Calculated, and How they can be Utilized by Farmers.

It may be of interest to some to know how ton values are calculated, using the valuations for the constituents just given. The amount or percentage of either of these constituents present in the fertilizers is given by the analysis. This represents parts per 100. The percentage is accordingly multiplied by the valuation per pound to get the value per 100 pounds. This is now multiplied by 20 to determine the value per ton (2,000 pounds). This is done for all three constituents, and the three amounts are added together to arrive at the cost value of the unmixed ingredients per ton at the seaboard.

The following is an example:

Percentage, or pounds per 100.	*Per 100 lbs.*	*Per ton (2,000 lbs.)*
9.64 Available Phosphoric Acid at 4c. per lb	$0.3856	$ 7.71
2.39 Ammonia at 12c. per lb	.2868	5.74
3.05 Potash at 5c. per lb	.1525	3.05
Total value	$ .8249	$16.50

The value per ton as here given represents the market price per ton at the seaboard of the unmixed ingredients. For interior points, railroad freights to those points must be added. To facilitate further comparison, a correct table of freight rates to prominent interior points in North Carolina is inserted on page 11. This table is carefully revised to date from the published rates of the joint railways in North Carolina and the adjoining States, and can be relied upon as accurate. The values per ton represent unmixed ingredients. They show what would be the approximate cost of the ingredients to a farmer in case he bought them himself for mixing. The cost is, as stated, on the basis of cash in small lots (less than five tons) in bags, at the seaboard. By a comparison of these values, as given by the Experiment Station, a farmer can see how much he is being charged over and above the actual cash cost of the unmixed raw materials. The manufacturer, however, has to allow for mixing the ingredients, branding the bags, handling, fixed charges, agents' commissions, profits, etc., together with freight to the interior points. The cost of mixing, sacking and branding the bags, will not vary greatly from $2.60 per ton.

Considering all items, the cash price of a mixed ammoniated fertilizer at an interior town ought not to be more than 25 to 33⅓ per cent greater than the realative seaboard value per ton of unmixed ingredients as given in the tables found by analysis, with, of course, the freight from the seaboard to the interior point added.

In the tables of analyses, first column, where "F" precedes the station number, it indicates that the sample was taken during the fall inspection of 1896. All others were sampled during the spring season of that year. In the tables of analyses, sixth column, the letters *n*, *d*, *v*, *s*, *b*, *p*, *y*, *w*, all refer to the mechanical condition of the fertilizers, as follows: *n*—fine, *d*—good, *r*—fair, *s*—coarse, *b*—very coarse, *p*—damp, *y**—lumpy, and *w*—wet.

FREIGHT RATES FROM THE SEABOARD TO INTERIOR POINTS.

CORRECTED TO JANUARY 20, 1897, FROM THE PUBLISHED RATES OF THE JOINT RAILWAYS IN NORTH CAROLINA AND ADJOINING STATES, AND FROM OTHER OFFICIAL SOURCES.

In Car loads of not less than 10 tons each, per ton of 2,000 pounds. Less than Car load, add 20 per cent.

DESTINATION.	From Wilmington, N. C.	From * Newbern, N. C.	From Norfolk and Portsmouth, Va.	Form Charleston, S. C.	From Richmond, Va.	DESTINATION.	From Wilmington, N. C.	From * Newbern, N. C.	From Norfolk and Portsmouth, Va.	From Charleston, S. C.	From Richmond, Va.
Aberdeen	$2 70	$----	$3 20	$3 80	$3 20	Magnolia	$1 95	$----	$3 20	$3 40	$3 20
Advance	3 70	----	4 10	4 30	3 50	Matthews	3 00	4 45	3 20	3 20	3 20
Apex	2 70	4 15	3 00	3 80	3 00	Maxton	2 20	3 65	3 80	3 50	3 80
Ashboro	3 40	----	3 80	3 80	3 20	Mebane	3 00	3 00	3 60	3 80	3 00
Asheville	4 00	----	4 60	4 25	4 00	Milton	3 50	----	----	----	2 30
Carthage	3 00	----	3 50	4 10	3 50	Mocksville	3 70	----	4 10	4 30	3 50
Chadbourn	2 00	----	3 80	2 70	3 80	Monroe	3 00	4 45	3 20	3 20	3 20
Chapel Hill	3 20	----	3 80	3 90	3 20	Morven	2 70	----	3 80	2 70	3 80
Charlotte	3 00	4 45	3 20	3 20	3 20	Mount Airy	3 20	4 45	3 40	4 20	3 40
Clayton	2 70	2 70	3 60	3 80	3 00	Mount Olive	2 05	----	3 20	3 40	3 20
Cherryville	3 30	4 75	3 60	3 40	3 60	Nashville	2 40	----	3 00	3 40	3 00
Clinton	2 05	----	3 20	3 40	3 20	Newbern	1 75	----	3 30	3 95	3 30
Creedmore	3 00	----	3 00	3 80	3 00	Newton	4 00	----	4 00	4 25	4 00
Cunningham	3 50	----	----	----	2 40	Norwood	3 40	----	3 80	3 80	3 20
Dallas	3 40	----	3 60	3 40	3 60	Oxford	3 20	----	3 60	3 80	3 00
Davidson	3 90	----	4 50	4 15	3 90	Palmyra	3 00	----	2 00	3 50	3 00
Dudley	2 05	----	3 20	3 40	3 20	Pineville	3 20	----	3 95	3 20	3 45
Dunn	2 40	2 40	3 00	3 40	3 00	Pittsboro	3 00	4 45	3 30	4 10	3 30
Durham	3 00	3 00	3 00	3 80	3 00	Polkton	2 75	4 20	3 20	3 20	3 20
Elkin	3 40	----	3 80	4 40	3 20	Raleigh	2 70	2 70	3 00	3 80	3 00
Elm City	2 40	2 40	2 90	3 40	2 90	Reidsville	3 40	----	3 00	3 80	2 40
Fair Bluff	2 10	3 55	3 80	2 70	3 80	Rockingham	2 70	4 15	3 20	3 80	3 20
Fayetteville	1 60	2 40	3 00	3 00	3 00	Rocky Mount	2 40	2 40	2 60	3 40	2 60
Forestville	3 00	----	3 00	3 80	3 00	Ruffin	3 40	----	2 80	3 80	2 20
Gastonia	3 40	----	3 60	3 40	3 60	Rural Hall	3 20	4 45	3 20	4 00	3 20
Gibson's	2 70	3 95	3 80	2 70	3 80	Rutherfordton	3 40	4 85	3 65	3 40	3 65
Goldsboro	2 00	1 25	3 00	3 40	3 00	Salisbury	3 40	3 50	3 80	3 70	3 20
Greenville	2 50	----	2 50	3 50	2 50	Sanford	2 20	3 65	3 00	3 80	3 00
Greensboro	3 00	3 00	3 00	3 80	3 00	Selma	2 40	2 40	3 00	3 40	3 00
Hamlet	2 70	3 95	3 20	3 60	3 20	Shelby	3 40	4 85	3 60	3 40	3 60
Henderson	3 00	----	3 00	3 80	3 00	Siler City	2 40	3 85	3 60	3 80	3 60
Hendersonville	4 25	----	4 75	4 25	4 25	Southern Pines	2 70	4 15	3 20	3 80	3 20
Hickory	4 00	----	4 00	4 25	4 00	Smithfield	2 40	2 40	3 00	3 40	3 00
High Point	3 40	3 40	3 80	3 80	3 20	Spring Hope	2 40	----	3 00	3 40	3 00
Hillsboro	3 00	3 00	3 60	3 80	3 00	Statesville	3 20	----	3 80	4 00	3 20
Kenly	2 40	----	2 90	3 40	2 90	Stem	3 20	----	3 60	3 80	3 00
Kelford	3 60	----	2 00	4 55	3 60	Tarboro	2 50	----	2 50	3 00	2 50
Kernersville	3 20	----	3 60	3 80	3 00	Waco	3 30	4 75	3 60	3 40	3 60
Kinston	2 20	----	2 50	3 50	2 50	Wadesboro	2 70	4 15	3 20	2 70	3 20
La Grange	2 10	----	3 20	3 65	3 20	Walnut Cove	3 20	4 45	3 40	4 00	3 40
Laurel Hill	2 30	3 75	3 80	3 80	3 80	Warrenton	3 25	4 70	3 25	4 10	3 25
Laurinburg	2 30	3 75	3 80	3 80	3 80	Warsaw	2 00	3 45	3 20	3 40	3 20
Liberty	2 50	3 95	3 60	3 80	3 60	Washington	1 50	----	1 50	3 00	1 50
Louisburg	3 00	4 45	3 00	3 80	3 00	Weldon	2 45	----	2 00	3 85	2 00
Lumberton	2 20	3 65	3 80	3 70	3 80	Wilson	2 40	2 40	2 90	3 40	2 90
Macon	3 30	4 45	3 00	3 85	3 00	Winston-Salem	3 00	3 55	3 00	3 80	3 00
Madison	3 00	----	3 00	4 00	3 00						

* Rates from Newbern subject to correction.

Station Number.	Name of Brand.	Name of Manufacturer.	
9371	Acme Acid Phosphate 12 per ct	Acme Mfg. Co., Wilmington, N. C.	1
9388	Acme Acid Phosphate 13 per ct	Acme Mfg. Co., Wilmington, N. C	2
9385	Acme Fertilizer	Acme Mfg. Co., Wilmington, N. C	3
9398	Acme Fertilizer for Tobacco	Acme Mfg. Co., Wilmington, N. C	4
9506 F 9841	Allison & Addison Acid Phosphate.	Virginia-Carolina Chemical Co., Richmond, Va.	5
9647	Allison & Addison B. and P. Potash Mixture.	Virginia-Carolina Chemical Co., Richmond, Va.	6
F 9873	Allison & Addison's Rocketts Acid Phosphate. .	Virginia-Carolina Chemical Co., Richmond, Va.	7
9431 F 9894	Almont Acid Phosphate	Powers, Gibbs & Co., Wilmington, N.C	8
9410	Almont Ammoniated Guano	Powers, Gibbs & Co., Wilmington, N.C	9
9486 F 9837	Almont Ammoniated Dissolved Bone.	Powers, Gibbs & Co., Wilmington, N.C	10
F 9867	Almont Dissolved Bone with Potash.	Powers, Gibbs & Co., Wilmington, NC.	11
9505 F 9833	Almont High Grade Acid Phosphate.	Powers, Gibbs & Co., Wilmington, N.C	12
9711	Amazon High Grade Tobacco Manure.	Virginia-Carolina Chemical Co., Richmond, Va.	13
9598	American Fertilizing Co.'s Acid Phosphate.	American Fertilizing Co., Norfolk, Va.	14
9375	Ammoniated Bone Phosphate	Griffith & Boyd, Baltimore, Md.	15
9361	Ammoniated Soluble Navassa Guano.	Navassa Guano Co., Wilmington, N.C.	16
9502	Anchor Brand Fertilizer	Virginia-Carolina Chemical Co., Richmond, Va.	17
9501	Anchor Brand Tobacco Fertilizer.	Virginia-Carolina Chemical Co., Richmond, Va.	18
9347	Armour's All-Soluble Fertili'er	Armour Fertilizer Works, Chicago, Ill.	19
9652	Armour's Ammoniated Bone and Potash Mixture.	Armour Fertilizer Works, Chicago, Ill.	20
9342	Armour's Bone and Blood	Armour Fertilizer Works, Chicago, Ill.	21
9346	Armour's Bone Meal	Armour Fertilizer Works, Cnicago, Ill.	22
9419	Armour's Complete Fertilizer	Armour Fertilizer Works, Chicago, Ill.	23
9345	Armour's Ten Per Cent Truckers.	Armour Fertilizer Works, Chicago, Ill.	24
9466	Ashepoo Acid Phosphate, (ten per cent.)	Ashepoo Phosphate Co., Charleston, S. C.	25
9532	Ashepoo Acid Phosphate, (twelve per cent.)	Ashepoo Phosphate Co., Charleston, S. C.	26
9479	Ashepoo Fertilizer	Ashepoo Phosphate Co., Charleston, S. C.	27
9616	Baker's Standard Guano	Chemical Co. of Canton, Baltimore, Md.	28
9607 F 9900	Banner Fertilizer	Reidsville Fertilizer Co., Reidsville, N. C.	29
9354 F 9869	Baugh's Animal Bone and Potash Compound for all Crops	Baugh & Sons Co., Norfolk, Va	30
F 9864	Baugh's Bone Meal	Baugh & Sons Co., Norfolk, Va	31

NOTE. 9342—Total phosphoric acid in pure bone meal is valued at 3 cents per pound.
F 9864—Total phosphoric acid in pure bone meal is valued at 3 cents per pound.

	PLACE WHERE SAMPLE WAS TAKEN, AND MECHANICAL CONDITION OF FERTILIZER. (See page 11.)	Water.	Insoluble Phos Acid	Soluble Phos. Acid	Reverted Phos Acid	Available Phos. Acid.		Nitrogen.	Equivalent to Ammonia.		Potash.		Relative Seaboard Value per ton of Unmixed Ingredients.	
						Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.	Guaranteed.	Found.
													$	$
1	Maxton *n p* ..	17.14	0.72	10.93	2.61	13.54	12	..	...	....	....	....	9.60	10.83
2	Smithfield *n p*	16.02	0.96	11.62	2.09	13.71	13	..	...	.	.	....	10.40	10.97
3	Maxton *d*	12.30	0.67	6.29	2.44	8.73	8	2.49	3.02	3	2.56	2½	16.10	16.79
4	Springhope *n* .	15.45	0.47	6.12	2.17	8.29	8	2.94	3.57	3	2.52	2½	16.10	17.72
5	La Grange *n*	15.71	1.06	11.00	2.75	13.75	12	...	.	..		...	9.60	11.00
	Cherryville *n*	11.18	2.35	10.40	3.19	13.59		...	...	..				10.87
6	Rural Hall *n* .	15.48	0.64	8.44	4.15	12.59	10	...	...	..	**1.77**	2	10.00	11.84
7	Winston *d* ..	13.78	2.75	6.31	4.44	10.75	10	.	...	....	...	....	8.00	8.60
8	Smithfield *n p*	13.93	2.19	8.14	2.97	11.11	10	...	...	....	....	...	8.00	8.89
	Lexington *n* ..	14.55	3.91	9.25	4.03	13.28		...	..	...	..	...		10.62
9	Mount Olive *d*	10.63	3.80	5.95	2.42	8.37	8	2.37	2.88	2½	1.42	1	13.40	15.03
10	Williamston *d*	10.51	4.00	5.13	2.88	8.01	8	1.70	2.06	2	1.07	1	12.20	12.43
	Lincolnton *n* .	8.21	4.21	4.21	3.76	**7.97**		1.73	2.10		2.33			13.74
11	Reidsville *n* ..	12.19	1.29	6.98	4.80	11.78	10	...	...	..	1.28	1	9.00	10.70
12	La Grange *n* ..	14.08	1.33	11.01	2.99	14.00	13	...	...	...	.	..	10.40	11.20
	Lincolnton *n* .	12.56	1.46	11.59	2.88	14.47		...	.		..	...		11.58
13	Henderson *n* .	8.39	2.85	6.88	2.59	9.47	8	2.27	**2.76**	3	**2.36**	3	16.60	**16.56**
14	Lexington *n*	11.11	0.90	12.74	4.04	16.78	13	...	...	..	....	..	10.40	13.42
15	Fayetteville *n*	13.84	2.07	7.20	2.59	9.79	9	1.50	**1.82**	2	2.51	1½	13.50	14.71
16	Fayetteville *r*	14.02	2.34	7.16	2.31	9.47	8	2.25	2.73	2½	2.13	2	14.40	16.26
17	Kinston *d* ...	11.35	1.51	6.47	2.52	8.99	8	1.72	2.09	2	2.48	2	13.20	14.69
18	Kinston *d* ...	13.10	1.73	6.87	2.84	9.71	8½	2.34	2.84	2¾	2.33	2	15.40	16.91
19	Newbern *r* ...	5.91	4.40	2.05	6.61	8.66	8	3.75	4.55	3½	**3.44**	4	18.80	21.29
20	Henderson *n* .	7.94	1.77	3.85	5.56	9.41	8	3.41	4.14	3	1.64	1½	15.10	19.10
21	Newbern *d* ...	7.83	See	foot	n'te	...	.	6.28	7.62	7	...	..	23.40	25.98
22	Newbern *n* ..	4.24	12.74	0.24	10.47	**10.71**	12	3.48	4.22	3	....	....	16.80	18.69
23	Washington *r*	7.08	.		...	...	...	7.70	9.35	8	6.17	5	24.20	28.61
24	Newbern *d* .	8.19	...	...	...	..	..	8.52	10.34	10	3.49	3	27.00	28.30
25	Monroe *n*	11.47	1.85	9.83	2.52	12.35	10	...	...	...	...	..	8.00	9.88
26	Charlotte *n* .	12.34	1.94	12.09	2.46	14.55	12	...	...	....	....	..	9.60	11.64
27	Monroe *n p* ..	15.78	2.69	6.93	2.39	9.32	8	2.07	2.51	2	1.73	1	12.20	15.21
28	Newbern *n* ...	16.21	2.14	5.62	2.54	8.16	8	1.83	2.22	2	2.06	2	13.20	13.92
29	Asheboro *n* ..	15.41	2.55	5.88	1.84	**7.72**	8	1.99	2.42	2	1.62	1	12.20	13.60
	Thomasville *d*	13.28	2.89	5.54	3.25	8.79		1.83	2.22		1.61			13.97
30	Newbern *n p* .	17.63	2.21	6.78	2.23	9.01	8	2.07	2.51	2	2.14	2	13.20	15.38
	Greensboro *n*	18.47	2.83	6.38	2.09	8.47		1.79	2.17		**1.70**			13.69
31	Greensboro *r* .	7.75	See	foot	n'te		....	4.14	5.03	4	....	....	22.50	25.87

11 per cent is guaranteed, 12.82 per cent is found.
21½ per cent is guaranteed, 23.01 per cent. is found.

Station Number.	NAME OF BRAND.	NAME OF MANUFACTURER.	
9698	Baugh's Dissolved Animal Bones.	Baugh & Sons Co., Norfolk, Va	32
9606	Baugh's Fertilizer Chemicals	Baugh & Sons Co., Norfolk, Va	33
9377 9643 F 9889	Baugh's High Grade Acid Phosphate or Dissolved S. C. Rock.	Baugh & Sons Co., Norfolk, Va	34
9353	Baugh's High Grade Tobacco Manure.	Baugh & Sons Co., Norfolk, Va	35
9618	Baugh's New Process Ten Per Cent Guano.	Baugh & Sons Co., Norfolk, Va	36
9411	Baugh's Raw Bone Superphosphate.	Baugh & Sons Co., Norfolk, Va	37
9560	Baugh's Special Cotton Guano	Baugh & Sons Co., Norfolk, Va	38
9429	Baugh's Special Substitute for Peruvian Guano.	Baugh & Sons Co., Norfolk, Va	39
9578	Beacom's Special Tobacco Compound.	Virginia-Carolina Chemical Co., Richmond, Va.	40
9681	Beam's High Grade Dissolved Bone Phosphate.	J. H. Beam, Lattimore, N. C	41
9686	Beam's Special Cotton Mixture	J. H. Beam, Lattimore, N. C	42
9365 9416 F 9903	Beef, Blood and Bone Fertilizer	Virginia-Carolina Chemical Co., Richmond, Va.	43
F 9895	Blue Ridge Dissolved Bone	Imperial Fertilizer Co., Charleston, S. C.	44
F 9877	Blue Ridge Wheat Grower	Imperial Fertilizer Co., Charleston, S. C.	45
9608	Bonanza Tobacco Grower	Virginia-Carolina Chemical Co., Richmond, Va.	46
9632	Bone, Blood and Potash Fertilizers.	Armour Fertilizing Co., Chicago, Ill.	47
9604 F 9883	Bone Meal	S. H. Ward & Sons, Jamestown, N.C.	48
9706	Bone Meal	Henry Potter, Jamestown, N. C	49
F 9907	Bone Meal	Ragsdale & Smith, Jamestown, N. C.	50
9570	Bradley's Patent Superphosphate of Lime.	Bradley Fertilizer Co., Boston, Mass.	51
9565	Bright Leaf Tobacco Grower	Virginia-Carolina Chemical Co., Richmond, Va.	52
9574	British Mixture	Slingluff & Co., Baltimore, Md	53
9622	Broad Leaf Tobacco Guano	Reidsville Fertilizer Co., Reidsville, N. C.	54
9683	Bullock's High Grade Ammoniated Bone Cotton Guano.	Virginia-Carolina Chemical Co., Richmond, Va.	55
9531 F 9857	Capital Dissolved S. C. Bone	Virginia-Carolina Chemical Co., Richmond, Va.	56
9483	Capital Tobacco Fertilizer	Virginia-Carolina Chemical Co., Richmond, Va.	57

NOTE. 9604—Total phosphoric acid in pure bone meal is valued at 3 cents per pound.
F 9883—Total phosphoric acid in pure bone meal is valued at 3 cents per pound.
9706—Total phosphoric acid in pure bone meal is valued at 3 cents per pound.
F 9907—Total phosphoric acid in pure bone meal is valued at 3 cents per pound.

	Place where Sample was taken, and Mechanical Condition of Fertilizer. (See page 11.)	Water.	Insoluble Phos Acid	Soluble Phos. Acid	Reverted Phos Acid	Available Phos. Acid.		Nitrogen.	Equivalent to Ammonia.		Potash.		Relative Seaboard Value per ton of Unmixed Ingredients.	
						Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.	Guaranteed.	Found.
													$	$
32	Winston *d*	5.31	0.83	12.61	5.02	17.63	11	3.67	4.46	3	....	...	16.00	24.81
33	High Point *d*.	12.79	1.30	3 85	4.20	8.05	8	2.49	3.02	2	4.15	1	12.20	17.84
34	Tarboro *n*	13.01	2.30	7.42	6.34	**13.76**	14	...	...	..	....	....	11.20	**11.00**
	Bosley *n*	15.70	0.95	10.39	4.23	14.62		...	...	....	...	....		11.70
	Salisbury *n* ..	15.18	1.87	10.89	2.69	**13.58**		-	..	...	....	....		**10.86**
35	Newbern *n*...	16.28	1.78	7.41	1.93	9.34	8	2.96	3.59	3	3.02	3	16.60	19.11
36	Moyock *n*	12.42	1.23	5.30	1.21	6.51	5	9.12	11.07	10	2.93	2½	30.50	34.70
37	Dudley *n*	12.60	2.87	6.43	2.98	9.41	8	1.96	2.38	2	1.34	1	12 20	14.58
38	Clayton *n* ..	13.45	3.35	6.28	3.34	9 62	8	2.07	2 51	2	....	....	11.20	13.72
39	Washington *s*	10.83	1.50	5.99	1.50	7.49	6	4.46	5.41	5	7.29	7	23.80	26.27
40	Henderson *n* .	14 37	1.45	6.79	2.33	9.12	8	2.40	2.91	2½	2.46	2	14.40	16.74
41	Lattimore *n*..	14.18	2.38	10.30	2.89	13.19	13	...	...	....	....	....	10.40	10.55
42	Lattimore *n*..	12.10	2 69	6 91	3.05	9.96	8	2.06	2.50	2	2.22	2	13.20	16.19
43	Selma *d*	12.40	1.36	6.09	3.19	9.28	8	1.87	2 27	2	1.16	1	12.20	14.03
	Maxton *s*.....	14 71	1.37	5.96	2.87	8.83		2.07	2 51		1 31			14.39
	Thomasville *d*	9.57	3.24	5.50	3.59	9 09		1.67	2.03		1.31			13.45
44	Lexington *n*..	14.03	2.33	10.36	2.43	**12 79**	13	...	...	....	....	....	10.40	**10.23**
45	North Wilkesboro *d*	15.01	1.02	6.52	5.15	11.67	10	...	...	....	2.50	2	10.00	11.83
46	Gibsonville *n*.	13.85	2.55	6.88	2.51	9.39	8	2 09	2.54	2	**1.94**	2	13.20	15.55
47	Enfield *n*.....	8.55	1.56	6.38	3.91	10 29	8	4.85	5.89	5	7.31	7	25.40	29.68
48	High Point *s* .	8.08	See	foot	n'te	....	....	5.58	6.77	3½	....	..	18.00	28.93
	High Point *b*.	7.78	See	foot	n'te	....	....	3.94	4.78		....	....		24.27
49	Jamestown *s*.	8 92	See	foot	n'te	....	....	4.14	5.03	3½	....	..	18.00	24.63
50	High Point *s*.	9.52	See	foot	n'te		....	3.94	4.78	3½	....	....	18.00	25.24
51	Springhope *n*.	13.86	2.12	7.33	2.61	9.94	9	2.07	2.51	2¼	1.13	1	13.60	15.10
52	Newbern *d*...	16.83	0.84	6.92	1.87	8.79	8	2.75	3 34	3	3.30	3	16.60	18.35
53	Roxboro *n*....	12.45	1.47	8.20	1.36	9.56	8	2.27	2.76	2½	2.69	2½	14.90	16.96
54	Reidsville*n* ..	14.93	1.83	6.20	1.39	**7.59**	8	1.41	**1.71**	2½	2.92	2½	14.90	**13.10**
55	Rowland *d* ...	17.17	1.30	6.73	2.46	9.19	8	1.83	2.20	2	2.43	2	13.20	15.11
56	Charlotte *np*.	15.27	0.64	11.14	2.23	13.37	12	...	...	....	....	....	9.60	10.69
	Statesville *n*..	13.88	3.22	8.48	3.65	12.13		...	...	....	....	....		9.71
57	Greenville *d*..	13.90	1.97	6.65	1.99	8.64	8	3.52	4.27	4	3.15	3	19.00	20.31

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16 per cent is guaranteed, 21.13 per cent is found.
16 per cent is guaranteed, 21.33 per cent is found.
16 per cent is guaranteed, 20.93 per cent is found.
16 per cent is guaranteed, 22.96 per cent is found.

Station Number.	Name of Brand.	Name of Manufacturer.	
9629	Caraleigh Special for Vines and Fruit Trees	Caraleigh Phosphate and Fertilizer Works, Raleigh, N. C.	58
9437	Carolina Acid Phosphate	F. S. Royster, Tarboro, N. C	59
9500	Carolina Golden Belt Ammoniated Guano for Tobacco.	Powers, Gibbs & Co., Wilmington, NC.	60
9539	Carolina Golden Belt Ammoniated Guano for Tobacco.	Powers, Gibbs & Co., Wilmington, NC.	61
F 9859	Carolina Soluble Bone and Potash.	Columbia Guano Co., Norfolk, Va	62
9476	Carolina Soluble Guano	Columbia Guano Co., Norfolk, Va	63
9408	Catawba Acid	Charlotte Oil and Fertilizer Co., Charlotte, N. C.	64
F 9890	Catawba Acid Phosphate	Charlotte Oil and Fertilizer Co., Charlotte, N. C.	65
9673	Catawba Guano	Charlotte Oil and Fertilizer Co., Charlotte, N. C.	66
9390	Cerealite Top Dressing	Boykin, Carmer & Co., Baltimore, Md.	67
9663 F 9871	Champion Acid Phosphate	Virginia-Carolina Chemical Co., Richmond, Va.	68
9646	Champion Acid Phosphate, with Potash.	Virginia-Carolina Chemical Co., Richmond, Va.	69
9620	Champion Fertilizer	Reidsville Fertilizer Co., Reidsville, N. C.	70
9393 F 9885	Charlotte Acid Phosphate	Charlotte Oil and Fertilizer Co., Charlotte, N. C.	71
9400 9655	Charlotte Ammoniated Fertilizer.	Charlotte Oil and Fertilizer Co., Charlotte, N. C.	72
9674	Charlotte Ammoniated Fertilizer (blood goods).	Charlotte Oil and Fertilizer Co., Charlotte, N. C.	73
9465 F 9888	Charlotte Dissolved Bone	Charlotte Oil and Fertilizer Co., Charlotte, N. C.	74
9600	Charlotte Dissolved Bone and Potash.	Charlotte Oil and Fertilizer Co., Charlotte, N. C.	75
9631	Charlotte High Grade Tobacco Fertilizer.	Charlotte Oil and Fertilizer Co., Charlotte, N. C.	76
9463	Chicora Acid Phosphate, (12 per cent)	Chicora Fertilizer Co., Charleston, S.C.	77
9627	Chicora Acid Phosphate, (13 per cent.)	Chicora Fertilizer Co., Charleston, S.C.	78
F 9899	Chicora Acid Phosphate and Potash Mixture.	Chicora Fertilizer Co., Charleston, S.C.	79
9464	Chicora Acid Phosphate with Potash.	Chicora Fertilizer Co., Charleston, S.C.	80
F 9893	Chicora High Grade Dissolved Bone.	Chicora Fertilizer Co., Charleston, S.C.	81
9477	Chicora Soluble Guano	Chicora Fertilizer Co., Charleston, S.C.	82
9451	Climax Dissolved Bone	Caraleigh Phosphate and Fertilizer Works, Raleigh, N. C.	83
9432	Columbia Thirteen Per Cent Acid Phosphate.	Columbia Guano Co., Norfolk, Va	84
9462 F 9875	Columbia Acid Phosphate	Columbia Guano Co., Norfolk, Va	85
9534 F 9878	Columbia Bone and Potash Mixture.	Columbia Guano Co., Norfolk, Va	86

	Place where Sample was taken, and Mechanical Condition of Fertilizer. (See page 11.)	Water.	Insoluble Phos Acid	Soluole Phos. Acid.	Reverted Phos Acid	Available Phos. Acid.		Nitrogen.	Equivalent to Ammonia.		Potash.		Relative Seaboard Value per ton of Unmixed Ingredients.	
						Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.	Guaranteed.	Found.
													$	$
58	Kernersville *n*	14.16	1.18	8 00	2.49	10.49	9½	1.43	**1.74**	2	5 26	5	17.40	17.83
59	Clinton *n* ..	14.03	2 30	6.47	4.53	11.00	10	---	---	---	---	----	8.00	8.80
60	Springhope *n* -	11.23	3 67	4 85	3.39	8 24	8	2 49	3 02	2½	**2.79**	3	15 40	16.63
61	Apex *d* ------	10 95	3 24	6 68	2.19	8.87	8	2 64	3.20	2½	3 00	3	15 40	17.77
62	Hickory *n* ---	15 50	0 13	5 03	2 43	**7.46**	8	---	---	..	2.48	2	8.40	8 44
63	Monroe *d* -----	16.34	1.42	5 91	2.14	8.05	8	1 67	2.03	2	1 76	1	12.20	13.07
64	Maxton *n* ..	14 12	0.15	8.83	1 95	10.78	10	---	---	----	----	----	8 00	8.62
65	Lexington *n* ..	12.36	1.06	7.65	2.97	10 62	10	---	---	---	----	----	8.00	8.50
66	Louisburg *n* ..	9 95	0.26	6 04	3.14	9 18	8	2 27	2.76	2	1.15	1	12.20	15 12
67	Maxton *s*	6.77	---	--	--	---	---	7.66	9.30	9	4 00	2½	24.10	26.32
68	Maxton *n*	12.07	2.07	5.08	5 49	10.57	10	---	---	---	---	----	8.00	8 45
	N. Wilkesb'o *n*	11 18	3 36	5.17	5.41	10.58		---	---	--	---			8.46
69	N. Wilkesb'o *n*	12.81	0.59	4.17	6.33	10.50	10	---	-	----	1.39	1	9.00	9.79
70	Reidsville *n* ..	14.46	1 47	6 74	2.09	8.83	8	1.72	2.09	2	2.18	2	13.20	14.26
71	Maxton *np* ..	18.26	0.20	12.37	1.85	14.22	13	---	---	----	----	----	10.40	11.38
	Thomasville *n*	15.96	0.41	12.59	1.90	14 49		---	---	---	---	---		11 59
72	Rocky Mt. *n* ..	15.61	0 12	8 55	1.59	10.14	8	2.36	2.87	2½	1.89	1½	13.90	16.89
	Maxton *n*	14.06	0.13	8.39	2.16	10 55		2.09	2.54		2.48			17.02
73	Hillsboro *n* ...	10.90	0 24	5.60	3 54	9.14	8	2.48	3.01	2½	1.61	1½	13.90	16 14
74	Monroe *n*	16.05	0.15	9 68	1.81	**11.49**	12	---	---	----	----	---	9.60	**9.19**
	Salisbury *n* ...	14.46	0.36	11.00	1.86	12.86		---	---	----		---		10 28
75	Albemarle *n*	15 13	0.18	5.39	3.12	**8.51**	10	---	---	----	1.35	1	9.00	**8.16**
76	Winston *n* ...	14.31	0.51	7.74	2.65	10.39	9	2.08	2.53	2½	2.22	2	15.20	16.60
77	Monroe *n*	13.05	1.32	12.70	2.36	15.06	12	---	---	----	----	----	9.60	12.04
78	Winston *n* ...	14 06	1.55	12.69	2.38	15.07	13	---	---	----	----	----	10.40	12.05
79	Lexington *n* ..	15.47	2 02	8.80	2.41	11 21	10	---	---	----	2.21	2	10.00	11.18
80	Morven *n*	14.17	1 41	11.25	2 83	14.08	10	---	---	----	1.00	1	9.00	12.26
81	Lexington *n* ..	12 71	2.94	8.49	4.06	**12.55**	13	---	---	----	----	----	10.40	**10.04**
82	Monroe *np* ...	18.50	1 33	8 73	2 44	11.17	8	1.76	2.14	2	1.13	1	12.20	15.20
83	Wadesboro *n*	15.81	0 29	11.97	2.86	14.83	13	---	---	----	----	----	10.40	11.87
84	Four Oaks *np*	16.05	0.68	9.56	4.18	13.74	13	---	---	----	----	----	10.40	11.00
85	Monroe *n*	13.37	0 97	7.61	2.92	10.53	10	---	---	----	---	----	8.00	8.43
	Salem *n*	13.34	0 23	7.13	3 45	10.58		---	---	----	----	----		8.46
86	Kinston *n*	13 66	0 23	7.19	2.38	9.57	8	---	---	----	**1.83**	2	8.40	9.48
	Salem *n*	15.43	0.19	6.29	2.62	8.91		---	--	---	2.48			9.61

Station Number.	NAME OF BRAND.	NAME OF MANUFACTURER.	
9339 9540	Columbia High Grade Acid Phosphate.	Columbia Guano Co., Norfolk, Va...	87
9334	Columbia High Grade Special Tobacco Guano.	Columbia Guano Co., Norfolk, Va...	88
9333	Columbia Soluble Guano	Columbia Guano Co., Norfolk, Va...	89
9650	Cooper's Special Bright Tobacco Fertilizer.	Virginia-Carolina Chemical Co., Richmond, Va.	90
9544	Coree Tobacco Fertilizer .	Navassa Guano Co., Wilmington, N.C.	91
9533	Cotton Brand Acid Phosphate	Powers, Gibbs & Co., Wilmington, NC.	92
9535	Cotton Brand Ammoniated Dissolved Bone.	Powers, Gibbs & Co., Wilmington, NC.	93
9338	Cotton Brand High Grade Acid Phosphate.	Powers, Gibbs & Co., Wilmington, NC.	94
9407 F 9909	Crenshaw's Acid Phosphate, or Dissolved S. C. Bone.	Virginia-Carolina Chemical Co., Richmond, Va.	95
9699	Croom's Special Tobacco Fertilizer.	Charlotte Oil and Fertilizer Co., Charlotte, N. C.	96
9554	Crown Brand Ammoniated Fertilizer.	Caraleigh Phosphate and Fertilizer Works, Raleigh, N. C.	97
9564	Crumpler's Standard Premium Guano.	Virginia-Carolina Chemical Co., Richmond, Va.	98
9449	Darlington Dissolved Bone...	Darlington Phosphate Co., Darlington, S. C.	99
9641	Davie & Whittle Acid Phosphate (ten per cent).	Virginia-Carolina Chemical Co., Richmond, Va.	100
9582	Davie & Whittle Acid Phosphate (13 per cent.)	Virginia-Carolina Chemical Co., Richmond, Va.	101
9467	Detrick's Acid Phosphate ..	Detrick Fertilizer and Chemical Co., Baltimore, Md.	102
9461 9581	Diamond Acid Phosphate ..	E. H. & J. A. Meadows Co., Newbern, N. C.	103
9450 F 9843	Diamond Soluble Bone	Etiwan Phosphate Works, Charleston, S. C.	104
9613	Dissolved Bone and Potash for Corn and Wheat.	American Fertilizing Co., Norfolk, Va.	105
9413	Dixie Guano	Rasin Fertilizer Co., Baltimore, Md ..	106
9513 9654 F 9905	Durham Ammoniated Fertilizer.	Virginia-Carolina Chemical Co., Richmond, Va.	107
9519	Durham High Grade Acid Phosphate.	Virginia-Carolina Chemical Co., Richmond, Va.	108
9394 F 9832	Double Bone Phosphate......	Virginia-Carolina Chemical Co., Richmond, Va.	109
9422 9638	Eagle Island Ammoniated Guano.	Powers, Gibbs & Co., Wilmington, N.C	110
9447	Early Trucker	Lazaretto Guano Co., Baltimore, Md.	111
9656	Early Trucker for Promoting Quick Growth.	Patapsco Guano Co., Baltimore, Md.	112
9368	Eclipse Ammoniated Guano..	Caraleigh Phosphate and Fertilizer Works, Raleigh, N. C.	113
9475	Edisto Ammoniated Fertilizer	Edisto Phosphate Co., Charleston, S.C.	114
9468	Empire Guano	Rasin Fertilizer Co., Baltimore, Md..	115

	PLACE WHERE SAMPLE WAS TAKEN, AND MECHANICAL CONDITION OF FERTILIZER. (See page 11.)	Water.	Insoluble Phos Acid	Soluble Phos. Acid.	Reverted Phos Acid	Available Phos. Acid.		Nitrogen.	Equivalent to Ammonia.		Potash.		Relative Seaboard Value per ton of Unmixed Ingredients.	
						Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.	Guaranteed.	Found.
													$	$
87	Kinston *n*	13.41	0 38	7.24	6.93	14.17	12	---	---	---	---	---	9.60	11.33
	Matthews *n*	14 46	0 63	8.94	4.16	13.10		---	---	---		-		10.48
88	Kinston *r*	15.54	0.46	6.13	2.20	8.33	8	2.05	2 49	2¼	2.17	2	13.80	14.81
89	Kinston *d*	16.01	0.74	5.69	2.42	8 11	8	1.91	2 32	2	2.14	1½	12 70	14.19
90	Henderson *n*	12.04	1.93	7.14	2.70	9.84	8	2.77	3.36	3	3.52	2½	16.10	19.45
91	Rowland *n*	14.35	1.83	6.96	2.08	9.04	8	3.40	4.13	4	3.96	4	20.00	21.10
92	Wakulla *n*	15.73	1.54	10.30	3.09	13.39	12	---	---	---	---	---	9.60	10.71
93	Goldsboro *n*	12.42	3.31	5.26	3.14	8.40	8	1.87	2.27	2	1.17	1	12.20	13.34
94	Goldsboro *n*	14.52	0.81	11.99	2.30	14.29	13	---	---	---	---	---	10.40	11.43
95	Benson *n*	14.26	1.60	10.43	3.45	13.88	13	---	---	---	---	---	10.40	11.10
	Albemarle *n*	11.13	3.54	4.91	7.30	12.21		---	-	---		---		---
96	Walnut Cove *n*	14.28	0.46	3.03	2.01	5.04	8	3.14	3.81	3	3.04	2	15.60	16.21
97	Fayetteville *n*	11.71	1.89	7.78	3.35	11.13	9	1.76	2.14	2	1.14	1	13.00	15.18
98	Washington *r*	16.98	2.69	5.54	2.30	7.84	8	2.06	2.50	2	2.00	1½	12.70	14.28
99	Rockingh'm *n*	14.00	0.65	12.61	2.99	15.60	13	---	---	---	---	---	10.40	12.48
100	Elkin *n*	14.08	1.28	5.33	5 85	11.18	10	---	---	---	---	---	8.00	8.94
101	Norwood *n*	13.54	1.88	8.28	4.81	13.09	12	---	---	---	---	---	9.60	10.47
102	Edenton *n*	12.11	0.75	12.50	2.54	15.04	14	---	---	---	---	---	11.20	12.04
103	Maysville *n*	15.35	0.75	11.00	3.61	14.61	14	---	---	---	---	---	11.20	11.69
	Kinston, *n*	14.47	0.42	11.44	3.59	15.03		---	---	---	---	---		12.03
104	Wadesboro *n*	11.44	2.81	12.04	2.54	14.58	13	---	---	---	---		10.40	11.66
	Cherryville *r*	9.77	1.64	11.44	3.36	14.80		---	---	---	---			11.84
105	Lexington *n*	11.56	1.02	4.29	7.02	11.31	10	---	---	---	2.78	2	10.00	11.83
106	Lumberton *n*	16.12	2.01	6.27	2.38	8.65	8	1.97	2.39	2	1.26	1	12.20	13.92
107	Wilson *n*	16.26	0.83	7.91	2.70	10.61	8	1.66	2.02	2	2.83	1½	12.70	16.16
	Marshville *n*	14.59	1.05	6.56	2.47	9.03		1.86	2.26		1.59			14.23
	Lexington *d*	10.29	2.61	5.92	3.30	9.22		1.60	1.94		1.75			13.78
108	Waxhaw *n*	14.86	1.25	7.89	3.24	11.13	10	---	---	---	---	---	8.00	8.91
109	Maxton *n*	16.84	1.73	10.35	3.78	14.13	13	---	---	---	---	---	10.40	11.31
	Lattimore *n*	11.91	2.61	10.32	2.98	13.30		---	---	---		---		10.64
110	Washington *n*	8.89	5.67	4.67	2.85	7.52	8	1.86	2.26	2	2.61	2	13.20	14.05
	Waxhaw *n*	11.45	3.08	5.83	3 54	9.37		2.07	2.51		2.78			16.30
111	Washington *d*	10.81	1.59	6.04	1.79	7.83	7	3.83	4.65	5	5.59	5	22.60	23.02
112	Dunn *n*	11.31	1.37	6.17	2.25	8.42	7	3.76	4.56	5	4.87	5	22.60	22.55
113	Selma *d*	11.93	1.48	7.04	2.05	9.09	8	2.40	2.91	2½	1.78	1½	13.90	16.04
114	Morven *n*	15.55	4.13	6.09	2.19	8.28	8	2.58	3.12	2½	1.42	1	13.40	15.53
115	Monroe *d*	14.12	2.39	6.40	2.63	9.03	8	2.47	3.00	2.43	1.66	1½	13.73	16.09

Station Number.	Name of Brand.	Name of Manufacturer.	
F 9891	Etiwan Dissolved Bone	Etiwan Phosphate Works, Charleston, S. C.	116
F 9904	Etiwan Soluble Fertilizer	Etiwan Phosphate Works, Charleston, S. C.	117
F 9892	Etiwan XX Acid Phosphate	Etiwan Phosphate Works, Charleston, S. C.	118
9576 F 9840	Eureka Acid Phosphate, or Dissolved S. C. Bone.	Virginia-Carolina Chemical Co., Richmond, Va.	119
9402 F 9913	Eureka Ammoniated Bone Superphosphate.	Virginia-Carolina Chemical Co., Richmond, Va.	120
9514	Eureka Ammoniated Bone Superphosphate for Tobacco.	Virginia-Carolina Chemical Co., Richmond, Va.	121
9577	Excellent Georgia Standard Guano.	W. C MacMurphy & Co., Charleston, S. C.	122
9387	Farmer's Bone Fertilizer	F. S. Royster Guano Co., Tarboro, N.C.	123
9469	Farmer's Bone Fertilizer	F. S. Royster, Tarboro, N. C.	124
9556	Farmer's Favorite Fertilizer	Goldsboro Oil Co., Goldsboro, N. C	125
9523 F 9848	Farmer's Friend Fertilizer	Virginia-Carolina Chemical Co., Richmond, Va.	126
9562	Farmer's Friend High Grade Fertilizer.	Virginia-Carolina Chemical Co., Richmond, Va.	127
9481 9675	Farmer's Friend High Grade Special Tobacco Fertilizer.	Virginia-Carolina Chemical Co., Richmond. Va.	128
F 9901	Fertilizer Chemicals	Baugh & Sons Co., Norfolk, Va	129
F 9897	Finch & Harris Special Bone Potash for Wheat and Corn.	Powers, Gibbs & Co., Wilmington, NC.	130
9344	Fish, Fine Ground	Baugh & Sons Co., Norfolk, Va	131
9580	Franklin Guano Special Compound.	S. C. Vann, Franklinton, N. C	132
9619	Game Guano	Baltimore Guano Co., Baltimore, Md.	133
9384	Gem Fertilizer	Acme Mfg. Co., Wilmington, N. C	134
9446	Genuine Bone and Peruvian Guano.	Virginia-Carolina Chemical Co., Richmond, Va.	135
9484	Genuine Slaughter-House Bone Guano.	Virginia-Carolina Chemical Co., Richmond, Va.	136
9649	Genuine Slaughter-House Bone Guano for Tobacco.	Virginia-Carolina Chemical Co., Richmond, Va.	137
9331	Gibbs & Co.'s High Grade Ammoniated Phosphate.	Powers, Gibbs & Co., Wilmington, NC.	138
9651	Golden Leaf Bright Tobacco Guano.	Virginia-Carolina Chemical Co., Richmond. Va.	139
9617	Great Eastern General Vegetable Vine and Tobacco Fertilizer.	Great Eastern Fertilizer Co., New York, N. Y.	140
9572 F 9858	Great Wheat and Corn Grower Guano.	Virginia-Carolina Chemical Co., Richmond, Va.	141
9690	Halifax High Grade Guano	Virginia-Carolina Chemical Co., Richmond, Va.	142
9430	High Grade Premium Guano	Geo. L. Arps & Co., Norfolk, Va	143
9700	Hill's Bright Tobacco Guano	Jno. R. Hill, South Boston, Va	144
9391	Home Fertilizer Chemicals	Boykin, Carmer & Co., Baltimore, Md.	145
9687	Hyco Tobacco Fertilizer	Columbia Guano Co., Norfolk, Va	146

	Place where Sample was taken, and Mechanical Condition of Fertilizer. (See page 11.)	Water.	Insoluble Phos Acid	Soluble Phos. Acid.	Reverted Phos Acid	Available Phos. Acid.		Nitrogen.	Equivalent to Ammonia.		Potash.		Relative Seaboard Value per ton of Unmixed Ingredients.	
						Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.	Guaranteed.	Found.
													$	$
116	China Grove *n*	12.92	2.00	11.51	2.97	14.48	13	---	---	----	---	----	10.40	11 58
117	Concord *d*----	15.58	1.91	8.66	2.36	11.02	8	1.86	2.26	2	1.62	1	12.20	15.86
118	Concord *r*----	11.18	1.16	12.00	3.69	15.69	13	---	---	--	---	--	10.40	12.55
119	Pineville *n*---	14.49	1.55	9.38	2.50	11.88	10	---	---	----	----	----	8.00	9.50
	Hickory *n* ---	12 48	3.49	6 40	3 52	9.92		---	---	----	---	----		7.94
120	Springhope *r*	12.46	1.93	5.76	2 43	8 19	8	2 06	2.50	2	2.30	2	13.20	14.85
	Burlington *d*-	13 05	2.30	6 69	2.40	9 09		1.96	2 38		2 02			15.00
121	Wilson *n*-----	16 12	1.18	6 98	1.98	8.96	9	2.25	2.73	2½	2.29	2	15.20	16.01
122	Pineville *n*---	11.05	4.13	6 05	3 52	9.57	8	1.97	2.39	2	1.13	1	12.20	14.52
123	Dunn *d* -----	15.56	1.59	5 74	2.93	8.67	8	1.89	2.29	2	2.05	2	13 20	14.48
124	Monroe *d* ----	15.71	1.66	4 03	4.07	8 10	8	1 87	2 27	2	2.32	2	13.20	14.25
125	Wallace *n* -	13.20	1 28	6.18	2.75	8.93	8½	1.68	2 04	2	2.46	2	13 60	14.50
126	Waxhaw *d*---	12.05	0 77	6.31	2 41	8 72	8	2.21	2.68	2	2.28	2	13.20	15 69
	Lenoir *d* - --	15.51	2.72	5 49	3 74	9.23		1.76	2.14		2.28			14.80
127	Springhope *d*-	13.47	1.54	6.46	2 59	9.05	8	2 47	3.00	3	3.10	3	16.60	17.54
128	Washington *d*	12.57	1.15	6.55	2.42	8 97	8	2.46	2.99	3	3.12	3	16.60	17.47
	Madison *n* --	14.00	1.88	6.87	2 24	9 11		2.57	3.12		3 11			17.88
129	High Point *n*-	13.09	1.80	4.64	5.66	10.30	8	2.14	2.60	2	1.21	1	12.20	15.69
130	Thomasville *n*	13.75	1.33	7.43	4.33	11.76	10	---	---	---	2.78	3	11.00	12.18
131	Newbern *s* --	10.30	---	----	---	----	---	9.38	11.39	10	----	----	24.00	27.33
132	Franklinton *d*	13.55	0.64	7 54	2.30	9.84	8	1.57	1.91	2	1.68	1½	12.70	14.13
133	Newbern *n*---	18.27	1.96	6.04	2 14	8 18	8	1.77	2.15	2	1.77	2	13.20	13.47
134	Lumberton *d*-	14.55	0.58	7.16	1.98	9.14	8	1.86	2 26	2	2.18	2	13.20	14.91
135	Laurinburg *r*-	15.74	0.83	7.47	2.80	10.27	8	2.25	2.73	2½	1.66	2	14.40	16.43
136	Springhope *d*-	16.82	0.96	7.11	1.78	8.89	8	1.77	2.15	2	2.60	2	13.20	14.88
137	Roxboro *d*----	14.31	2.39	6.58	2 84	9.42	8	2.16	2 62	2½	2.09	2	14.40	15.91
138	Goldsboro *n* -	9.72	5.22	6.70	2.31	9.01	8	2.28	2.77	2½	2.17	1	13.40	16.02
139	Walnut C've *n*	12.77	1.57	6.82	1.77	8.59	8	2.36	2.87	2½	2.07	2	14.40	15.83
140	Moyock ----	11.02	1.27	5 92	2.89	8.81	8	2.12	2.57	2½	3.72	3	15.40	16.93
141	Roxboro *n* ----	12.68	1.70	7.39	3.22	10 61	10	---	---	----	1.38	1½	9.50	9.87
	Lattimore *n*--	12.15	2.47	8.38	4.07	12 45		---	---	----	1.01			10.97
142	Weldon *d* ----	12 91	1.47	6.33	2.46	8.79	8	2.47	3.00	3	3.12	3	16 60	17.35
143	Washington *d*	10.26	1.36	6.23	2.62	8 85	8	2.10	2.55	2	1.87	1½	12 70	15.07
144	Pelham *d* ----	9.43	2.35	6.14	1.87	8.01	8½	2.24	2.72	2¼	2.25	2¼	14.45	15.18
145	Maxton *s*- ----	8.41	---	----	---	----	----	6 64	8.06	7	8 04	7	23.80	27.39
146	Washington *n*	16.52	1.39	6.24	2.14	8.38	8	2.49	3.02	3	3.44	3	16.60	17.39

Station Number.	NAME OF BRAND.	NAME OF MANUFACTURER.	
9401	Imperial Bright Leaf Tobacco Grower.	Imperial Fertilizer Co., Charleston, S. C.	147
9489	Imperial Cotton Grower	Imperial Guano Co., Norfolk, Va	148
F 9879	Imperial Dissolved Bone	Imperial Fertilizer Co., Charleston, S. C.	149
9585	Imperial Soluble Guano	Imperial Fertilizer Co., Charleston, S. C.	150
9707	Iseley's Formula Dissolved Bone Potash and Chemicals.	Virginia-Carolina Chemical Co., Richmond, Va.	151
9597	I. X. L. Acid Phosphate	Virginia-Carolina Chemical Co., Richmond, Va.	152
9376	Kainit, Genuine German	Baugh & Sons Co., Norfolk, Va	153
9370	Kainit, Genuine German	Calder Bros., Wilmington, N C	154
9517	Kainit, Genuine German	Caraleigh Phosphate and Fertilizer Works, Raleigh, N. C.	155
9357	Kainit, Genuine German	Powers, Gibbs & Co., Wilmington, NC.	156
9458	Kainit, Genuine German	Virginia-Carolina Chemical Co., Richmond, Va.	157
9504	Kainit, Genuine German	H. Weil & Bros., Goldsboro. N. C	158
9516	Kainit, Genuine German	Wando Phosphate Co., Charleston, S. C.	159
9355	Kainit, German	Griffith & Boyd, Baltimore, Md	160
9340	Kainit, German	Virginia-Carolina Chemical Co., Richmond, Va.	161
9379	Kainit, German	R. N. Sweet, Wilmington, N. C	162
9495	Kainit, Old Reliable Brand, Genuine.	Jas. Bonday, Jr., & Co., Baltimore, Md.	163
9551	Kainit, Pure German	Acme Mfg. Co., Wilmington, N. C.	164
9448	Kainit, Pure German	W. C. MacMurphy & Co., Charleston, S. C.	165
9356 F 9884	Kainit, Unadulterated German.	Navassa Guano Co., Wilmington, N. C.	166
9525 9662	Latta & Myatt's Special Guano	Columbia Guano Co., Norfolk, Va	167
9383	Lattimer's Complete Fertilizer	Acme Mfg. Co., Wilmington, N. C.	168
9421	Lazaretto Acid Phosphate	Lazaretto Guano Co., Baltimore, Md.	169
9487	Lazaretto Crop Grower	Lazaretto Guano Co., Baltimore, Md.	170
9426	Lazaretto Crop Grower for Wheat.	Lazaretto Guano Co., Baltimore, Md.	171
9378	Lazaretto Special Tobacco Fertilizer.	Lazaretto Guano Co., Baltimore, Md.	172
9425	Lazaretto Ten Per Cent Guano	Lazaretto Guano Co., Baltimore, Md.	173
9363	Leader	Charlotte Oil and Fertilizer Co., Charlotte, N. C.	174
9538	Leader Tobacco Fertilizer	Charlotte Oil and Fertilizer Co., Charlotte, N. C.	175
9352	Lee Brand Guano	Virginia-Carolina Chemical Co., Richmond, Va.	176
9414 F 9852	Lister's Ammoniated Dissolved Bone Phosphate.	Lister's Agricultural Chemical Works, Newark, N. J.	177
F 9902	Lister's Standard Fertilizer Success.	Lister's Agricultural Chemical Works, Newark, N. J.	178

	PLACE WHERE SAMPLE WAS TAKEN, AND MECHANICAL CONDITION OF FERTILIZER. (See page 11.)	Water.	Insoluble Phos Acid	Soluble Phos. Acid.	Reverted Phos. Acid	Available Phos. Acid.		Nitrogen.	Equivalent to Ammonia.		Potash.		Relative Seaboard Value per ton of Unmixed Ingredients.	
						Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.	Guaranteed.	Found.
													$	$
147	Springhope *n*	14.50	2.35	7.29	1.86	9.15	8	2.70	3.28	3	2.85	3	16 60	18.04
148	Plymouth *d*	14.31	1.34	6.04	2.96	9.00	8	2.23	2.71	2	2.00	1½	12.70	15.71
149	North Wilkesboro *n*	14.65	1.36	10.02	3 63	13.65	12	---	---	---	---	---	9.60	10.92
150	Concord *n*	13.13	3.76	7.48	1.77	9.25	8	2.27	2.76	2	1.74	1	12.20	15.76
151	Burlington *d*	10.61	3 11	5.81	2.31	8.12	8	2.66	3.23	3	3.49	3	16.60	17.74
152	Lexington *n*	12.91	1.51	11.53	2.93	14.46	13	---	---	---	---	---	10.40	11.56
153	Tarboro *s*	6 80	---	---	---	---	---	---	---	---	12.26	12	12.00	12.26
154	Maxton *s*	4.83	---	---	---	---	---	---	---	---	**11.82**	12	12 00	**11.82**
155	Raleigh *s*	6.48	---	---	---	---	---	---	---	---	12.22	12	12.00	12.22
156	Fayetteville *s*	5.07	---	---	---	---	---	---	---	---	12.44	11½	11.50	12.44
157	Maxton *s*	3.97	---	---	---	---	---	---	---	---	13.12	11½	11.50	13.12
158	LaGrange *s*	3.81	---	---	---	---	---	---	---	---	12.76	12	12.00	12.76
159	Waxhaw *s*	3.77	---	---	---	---	---	---	---	---	12.62	10	10.00	12.62
160	Fayetteville *s*	3 32	---	---	---	---	---	---	---	---	12.10	11	11.00	12.10
161	Kinston *s*	4.33	---	---	---	---	---	---	---	---	11.72	11½	11.50	11.72
162	Lumberton *s*	4.95	---	---	---	---	---	---	---	---	12 04	11	11.00	12.04
163	Centre Bluff *s*	3.93	---	---	---	---	---	---	---	---	13.00	12	12.00	13.00
164	Lumb'r B'ge *n*	4.86	---	---	---	---	---	---	---	---	12.28	12	12.00	12.28
165	Wadesboro *r*	4.58	---	---	---	---	---	---	---	---	12.42	12	12.00	12.42
166	Fayetteville *s*	6.00	---	---	---	---	---	---	---	---	12.52	11½	11.50	12.52
	China Grove *s*	5.18	---	---	---	---	---	---	---	---	12.38			12.38
167	Raleigh *r*	15.38	0.58	8.47	2.94	11 41	10	2.14	**2.60**	2¾	1.60	1¼	15 85	16.97
	Moncure *d*	15.29	1.05	8.48	2.65	11.13		2.22	**2.70**		1.27		15 85	16.66
168	Lumberton *d*	13.62	0.45	6 91	2 18	9 09	8	2.27	2.76	2½	2.30	2	14.40	16.20
169	Washington *n*	11.95	1.32	9.52	4.98	14.50	14	---	---	---	---	---	11.20	11.60
170	Washington *n*	14 39	1.66	6 98	3.19	10.17	9	1.73	2.10	2	1.56	1½	13.50	14.73
171	Washington *n*	12.49	1.34	6 92	2 36	**9.28**	10	1.73	2.10	2	**1.69**	2	14.80	**14.15**
172	Greenville *n*	14.74	0.92	6.63	2.17	**8.80**	9	2.61	3.17	3	3.13	3	17.40	17.78
173	Washington *r*	8.30	1.10	5.25	1.79	7.04	6	7.00	**8.50**	10	3.54	3	31.80	**29.58**
174	Selma *n*	11.89	0.12	5.40	2.50	**7.90**	8	2.14	2.60	2¼	2.20	2	13.80	14.76
175	Apex *n*	11.64	0.17	5.95	2.11	8.06	8	2.37	2.88	2¼	2 02	2	13.80	15.38
176	Newbern *d*	13.52	1.16	6 09	3.10	9.19	8	2.13	2.59	2	2.26	2	13.20	15.83
177	Lumberton *n*	13.56	2.65	7.55	1.91	9.46	8	2.31	2.80	2½	2.13	2	14.40	16.42
	Newton *n*	16 58	2.20	6 95	2.34	9 29		2.20	2.67	---	2.50			16.34
178	Thomasville *n*	16.33	1.94	7.23	2.51	9.74	8	1.92	2.33	2	2.42	2	13.20	15.80

Station Number.	NAME OF BRAND.	NAME OF MANUFACTURER.	
9685	Lion Brand Fertilizer	Reidsville Fertilizer Co., Reidsville, N. C.	179
9601 F 9868	McGavock Special Potash Mixture.	Virginia-Carolina Chemical Co.,Richmond, Va.	180
9406	Macmurphy's High Grade Acid Phosphate.	W. C. Macmurphy & Co., Charleston, S. C.	181
9553	Mapes' Complete Manure, "A" Brand.	Mape's Formula and Peruvian Guano Co., New York, N. Y.	182
9474	Mapes' Potato Manure	Mapes Formula and Peruvian Guano Co., New York, N. Y.	183
9558	Marlboro Acid Phosphate	Marlboro Mill Co., Bennettsville, S. C.	184
9337	Meadows' All-Crop Guano	E. H. & J. A. Meadows Co., Newbern, N. C.	185
9336	Meadows' Cotton Grower	E. H. & J. A. Meadows Co., Newbern, N. C.	186
9537	Meadows' Gold Leaf Tobacco Guano.	E. H. & J. A. Meadows Co., Newbern, N. C.	187
9472	Meadows' Great Potato Guano	E. H. & J. A. Meadows Co., Newbern, N. C.	188
9645	Meekin's Crop Grower	J. C. Meekin, Jr., & Co., Norfolk, Va.	189
9712	Miller's Ammoniated Dissolved Bone.	H. S. Miller, Newark, N. J	190
9341	Muriate of Potash	Baugh & Sons Co., Norfolk, Va	191
9527	Myatt's Extra High Grade Cotton Fertilizer.	Caraleigh Phosphate and Fertilizer Works, Raleigh, N. C.	192
9417	National Fertilizer	Virginia-Carolina Chemical Co.,Richmond, Va.	193
9369	National Special Tobacco Fertilizer.	Virginia-Carolina Chemical Co.,Richmond, Va.	194
9358 F 9845	Navassa Acid Phosphate	Navassa Guano Co.,Wilmington,N.C.	195
9552	Navassa Acid Phosphate with Potash.	Navassa Guano Co.,Wilmington,N.C.	196
9648	Navassa Bone and Potash	Navassa Guano Co.,Wilmington,N.C.	197
9434 F 9851	Navassa Complete Fertilizer	Navassa Guano Co.,Wilmington,N.C.	198
9412 9542	Navassa Cotton Fertilizer	Navassa Guano Co.,Wilmington,N.C.	199
9628 F 9876	Navassa Dissolved Bone Phosphate with Potash.	Navassa Guano Co.,Wilmington,N.C.	200
9603 F 9838	Navassa Grain Fertilizer	Navassa Guano Co.,Wilmington,N.C.	201
9549	Navassa Guano for Tobacco	Navassa Guano Co.,Wilmington,N.C.	202
9389 F 9834	Navassa High Grade Dissolved Bone Phosphate.	Navassa Guano Co.,Wilmington,N.C.	203
9602	Navassa Root Crop Fertilizer	Navassa Guano Co.,Wilmington,N.C.	204
9439	Navassa Strawberry Top Dressing.	Navassa Guano Co.,Wilmington.N.C.	205
9440	Navassa Universal Fertilizer	Navassa Guano Co.,Wilmington,N.C.	206
9343	Nitrate of Soda	Baugh & Sons Co., Norfolk, Va	207
9639	Norfolk Best Acid Phosphate	Virginia-Carolina Chemical Co.,Richmond, Va.	208

	Place where Sample was taken, and Mechanical Condition of Fertilizer. (See page 11.)	Water.	Insoluble Phos Acid	Soluble Phos. Acid.	Reverted Phos Acid	Available Phos. Acid.		Nitrogen.	Equivalent to Ammonia.		Potash.		Relative Seaboard Value per ton of Unmixed Ingredients.	
						Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.	Guaranteed.	Found.
													$	$
179	Ruffin *d*	16.70	2.46	5.96	2.59	**8.55**	9	2.69	3 27	3	6.86	6	20.40	21.55
180	Newton *n*	13.15	5.08	5.95	3.45	9 40	8	---	---	..	2.70	2½	8 90	10.22
	Greensboro *n*	11.05	6 74	4.85	3.53	8.38		---	---	----	**2.40**			9.10
181	Maxton *n*	14.32	1.19	11.63	2.19	13.82	13	..	---	.	---	..	10.40	11.06
182	Wallace *d*	10.31	2.55	6.38	3.80	10 18	10	3.19	3.87	3	3 55	2½	17.70	20.98
183	Rocky Point *d*	9.05	2.81	5.81	2.00	**7.81**	8	3.75	4.55	4½	7.97	6	23.20	25 14
184	Gibson *n*	12 66	1.88	11.63	2.81	14.44	12	---	-	----	-	---	9.60	11.56
185	Kinston *d*	14.94	0.58	7.68	2.36	10.04	9	2.08	2.53	2½	3.23	2½	15.70	17.33
186	Kinston *d*	16.02	0.43	6.78	2 64	9.42	8	2 26	2.74	2¼	3.04	2	13.80	17.15
187	Kinston *n*	18 00	0.56	8.35	2.71	11 06	9	2.71	3.29	3	3.18	3	17.40	19.93
188	Maysville *d*	8.79	1.37	5.40	1 70	7.10	7	4.40	5.34	5	8 52	8	25 60	27.01
189	Centreville *n*	12.47	2.51	5.27	3.82	9.09	8	1.66	2.02	2	---	..	11 20	12.12
190	Middleburg *n*	8.93	2.21	5.12	3 92	9 04	9	2.06	2.50	2.20	2.40	2 30	14 78	15.64
191	Newbern *b*	1.70	..	- -	---	..	----	-	- -	.	**49.28**	50	50.00	**49.28**
192	Raleigh *d*	12.86	1.47	8.57	2.52	11.09	10	2.61	3.17	2¾	**1.27**	1½	16.10	17.75
193	Maxton *r*	14.54	1.18	5 91	2 95	8.86	8	1.76	2.14	2	2.27	2	13 20	14.50
194	Selma *r*	10 88	1.62	5 92	3.51	9.43	8	1.78	2 16	2	2.14	2	13.20	14.86
195	Fayetteville *n*	14 67	1.83	10.20	3.73	13 93	12		---	---	----	----	9.60	11.15
	Cherryville	13.55	2.89	10 13	3.07	13.18			-	----		...		10.54
196	Burgaw *n*	14 46	4.85	7.01	4.71	11.72	10		---	----	**0.91**	1	9.00	10.29
197	Elkin *n*	13.63	1.91	5.16	4.65	9 81	8	---	---	---	2.03	2	8 40	9.88
198	Dunn *d*	13.64	3.24	5 85	3.60	9 45	8	1 74	2.11	2	1.43	1	12 20	14 05
	Newton *d*	14.63	3.22	5.32	3.54	8.86		1.75	2 12		1.40			13 58
199	Mt. Olive *d*	13.41	3 94	6 37	3.79	10.16	8	1.92	2.33	2	2.32	2	13.20	16 04
	Dunn *n*	13.41	3.62	6 09	4.16	10 25		2.07	2.51		2.31			16.53
200	Winston *n*	13.90	4.00	8.28	4.17	12.45	10	---	---	----	**1.45**	2	10.00	11.41
	Winston *n*	15.84	2.11	5.59	4.76	10.35		---	---	---	**1.75**			10.03
201	Lexington *n*	12.26	3.33	6.01	3.63	9.64	8	2.06	2.50	2	2.34	2	13.20	16.06
	Forest City *d*	14.21	2.58	5.90	3 39	9 29		1.74	2.11		**1.36**			13.86
202	Fair Bluff *d*	13 00	3.21	6.87	2.80	9.67	8	2.41	2.93	2½	2.37	2	14.40	17.14
203	Smithfield *n*	12.79	1.55	10.46	2.95	13.41	13	---	---	----	---	..	10.40	10.73
	Forest City *n*	12 41	2 64	10 09	3.33	13.42		---	---	..	---	..		10.74
204	Newton *n*	15 38	1.07	5.35	2 48	7.83	7	3.83	**4.65**	5	**6.22**	7	24.60	**23.65**
205	Wallace *n*	11.51	1.92	6 79	2.04	8.83	8	2.33	2.83	2½	4 52	4	16.40	18.38
206	Laurinburg *r*	12.84	2.81	6.64	2.22	8.86	8	1 97	**2.39**	2½	1.51	1	13 40	14.34
207	Newbern *b y*	1.13	---	---	--	----	----	**15.92**	**19.32**	19	----	. .	45 60	46 37
208	Roxboro *n*	14.90	2 61	11.45	2.32	13 77	13	---	---	----	---	..	10.40	11.01

Station Number.	Name of Brand.	Name of Manufacturer.	
9494 F 9872	Norfolk Soluble Bone	Virginia-Carolina Chemical Co., Richmond, Va.	209
9682	N. C. Bright Tobacco Fertilizer	W. H. Warriner & Co., Ruffin, N. C.	210
9415	N. C. Farmers' Alliance Official Guano.	Virginia-Carolina Chemical Co., Richmond, Va.	211
9599	N. C. Official Farmers' Alliance Acid Phosphate.	Virginia-Carolina Chemical Co., Richmond, Va.	212
9515	North State Guano	A. P. Branch, Wilson, N. C	213
9441	Ober's Special Ammoniated Dissolved Bone.	G. Ober & Sons' Co., Baltimore, Md	214
9623	Ober's Special Compound for Tobacco.	G. Ober & Sons' Co.. Baltimore, Md	215
9404	Ober's Special Cotton Compound.	G. Ober & Sons' Co., Baltimore, Md	216
9630	Ober's Standard Tobacco Fertilizer.	G. Ober & Sons' Co., Baltimore, Md	217
9397	Occoneechee Tobacco Fertilizer.	Navassa Guano Co., Wilmington, N C	218
9433 F 9846	Old Dominion Dissolved Bone and Potash.	Virginia-Carolina Chemical Co., Richmond, Va.	219
9503	Old Dominion Potato Manure	Virginia-Carolina Chemical Co., Richmond, Va.	220
9382 F 9835	Old Dominion Soluble Guano.	Virginia-Carolina Chemical Co., Richmond, Va.	221
9381	Old Dominion Soluble Tobacco Guano.	Virginia-Carolina Chemical Co., Richmond, Va.	222
9498	Old Dominion Truck Guano	Virginia-Carolina Chemical Co., Richmond, Va.	223
9499	Old Dominion Truck Guano	Virginia-Carolina Chemical Co., Richmond, Va.	224
9548	Old Hickory Guano	Virginia-Carolina Chemical Co., Richmond, Va.	225
9495 F 9847 F 9912	Orient Complete Manure	Virginia-Carolina Chemical Co., Richmond, Va.	226
9615	Orient Complete Manure, Special for Tobacco.	Virginia-Carolina Chemical Co., Richmond, Va.	227
9399 9541	Orinoco Tobacco Guano	F. S. Royster Guano Company, Tarboro, N. C.	228
F 9839	Our Acid Phosphate, or Dissolved S. C. Bone.	Virginia-Carolina Chemical Co., Richmond, Va.	229
9386	Owl Brand Guano	Virginia-Carolina Chemical Co., Richmond, Va.	230
F 9708	Owl Brand Guano for Tobacco	Virginia-Carolina Chemical Co., Richmond, Va.	231
9409	Owl Brand Special Tobacco Guano.	Virginia-Carolina Chemical Co., Richmond, Va.	232
9614	Owl Brand Special Tobacco Plant Guano.	Virginia-Carolina Chemical Co., Richmond, Va.	233
424	Pamlico Trucker	Lazaretto Guano Co., Baltimore, Md.	234
366	Patapsco Guano	Patapsco Guano Co ., Baltimore, Md.	235
9702	Patapsco Tobacco Fertilizer	Patapsco Guano Co., Baltimore, Md.	236

	Place where Sample was taken, and Mechanical Condition of Fertilizer. (See page 11.)	Water.	Insoluble Phos Acid	Soluble Phos. Acid.	Reverted Phos Acid	Available Phos. Acid.		Nitrogen.	Equivalent to Ammonia.		Potash.		Relative Seaboard Value per ton of Unmixed Ingredients.	
						Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.	Guaranteed.	Found.
													$	$
209	Monroe *n* ...	12.31	0.67	8 49	2.78	11.27	10	---	---	----	----	---	8.00	9.01
	N Wilk'sb'ro *n*	11.73	3 44	6.77	3.79	10.56		---	---	----	----	---		8.44
210	Ruffin *d*	17.83	2.81	6 37	2.49	8.86	8	2.27	2.76	2½	1.95	1½	13.90	15.72
211	Lumberton *s*.	12.72	1.75	6.15	2.49	8.64	8	2.11	2.56	2½	3 30	3	15.40	16.35
212	China Grove *n*	15.93	0.87	11.09	3.47	14 56	13	---	---	--	----	---	10.40	11.64
213	Wilson *d*.....	14.56	1.55	5.21	2.69	7.90	8	1.95	2.37	2	1.90	1	12.20	13.91
214	Laurinburg *d*	12.51	0.93	8.57	1.37	9.94	8	1.79	2.17	2	2.55	2	13.20	15.71
215	Reidsville *n*..	15.01	2.01	7.15	1.39	8.54	8	2.67	3.24	2½	3.75	2½	14.90	18.36
216	Springhope *d t*	13.88	3.23	7.07	1.77	8.84	8	2.22	2.70	2	1.87	1½	12.70	15.43
217	Winston *n* ...	15.52	3.39	8.02	1.28	9.30	8	2.64	3.20	2	2.10	1½	12.70	17.22
218	Rocky Mo'nt *d*	12.05	2.05	7.04	3.34	10.38	8	1.87	2.27	2	2.56	2	13.20	16.31
219	Dunn *n*	13.47	0.64	6.65	2.59	9.24	8½	---	---	----	2.06	2	8.80	9.46
	Lenoir *n*	15.47	2.51	2.72	5.45	8.17		---	---	---	2.40			8.93
220	Washington *r*	9.62	1.57	6.24	2.51	8.75	7	3.83	4.65	5	6.36	8	25.60	24.52
221	Lumberton *d*.	13.63	1.30	6.37	2.90	9.27	8	1.95	2.37	2	2.14	2	13.20	15.25
	Lattimore *d*..	13.35	2.47	5.74	3.71	9.45		1.67	2.03		2.31			14.74
222	Lumberton *r*.	15.39	1.23	6.47	2.56	9.03	8	2.07	2.51	2	2.15	2	13.20	15.39
223	Washington *r*	9.31	1.85	5.21	2.34	7.55	7	5.74	6.97	7	5.40	5	27.40	28.17
224	Washington *d*	8.20	1.36	5.40	2.34	7.74	7	5.44	6.60	7	7.50	7	29.40	29.54
225	Fair Bluff *n*..	18.77	1.84	7.07	2.36	9.43	8	2.28	2.77	2½	1.33	1	13.40	15.52
226	Springhope *r*.	14.94	1.75	6.79	2.27	9.06	8	1.86	2.26	2	1.44	1	12.20	14.11
	Hickory *r* ...	13.65	2.42	5.30	3.81	9.11		1.68	2.04		1.37			13.55
	Albemarle *d*..	10.26	2.87	4.93	3.13	8.06		1.86	2.26		1.42			13.29
227	Madison *d*....	13.51	1.98	6.50	2.41	8.91	8	2.17	2.63	2	2.23	2	13.20	15.67
228	Rocky Mo'nt *s*	15.41	0.77	5.03	2.95	7.98	8	2.52	3.06	2½	3.74	3	15.40	17.47
	LaGrange *r*..	13.98	1.19	5.58	2.75	8.33		2.41	2.93		3.31			17.01
229	Hickory *n*	12.79	2.76	10.27	2.99	13.26	12	---	---	--	----		9.60	10.60
230	Maxton *d*....	16.95	0.78	7.24	2.12	9.36	8½	1.69	2.05	2	1.51	1¼	12.85	13.91
231	East Bend *d*	14.00	1.80	6.23	2.22	8.45	8	1.94	2.36	2	2.16	2	13.20	14.58
232	Mt. Olive *sp*..	18.71	1.36	6.37	2.38	8.75	9	2.27	2.76	2.60	1.96	1¾	15.19	15.58
233	Madison *d*	18.95	0.64	7.39	1.88	9.27	9	2.60	3.16	2.60	2.29	1¾	15.19	17.29
234	Washington *n*	9.55	1.55	5.37	1.66	7.03	7	3.84	4.66	5	8.47	8	25.60	25.27
235	Selma *d*.	11.43	1.11	6.90	2.16	9.06	9¼	2.14	2.60	2½	1.79	1¼	14.65	15.27
236	Pelham *n*	12.25	1.60	6.36	1.79	8.15	9	2.51	3.05	3	3.21	3	17.40	17.05

Station Number.	Name of Brand.	Name of Manufacturer.	
F 9911	Peacock's Special High Grade Bone and Potash for Grain.	Navasa Guano Co., Wilmington, N. C	237
9453 9658	Pee Dee Fertiiizer	Darlington Phosphate Co., Darlington, S. C.	238
9435	Peruvian Mixture	American Fertilizing Co., Norfolk, Va	239
9684	Piedmont Essential Tobacco Compound.	Mt. Airy Mfg Co., Baltimore, Md	240
9471	Piedmont Guano for Cotton, Corn, Peanuts, etc.	Mt. Airy Mfg Co., Baltimore, Md	241
9536	Piedmont Guano for Tobacco	Mt. Airy Mfg Co., Baltimore, Md	242
9423	Piedmont Potato Producer	Mt. Airy Mfg Co., Baltimore, Md	243
9567	Pine Island Ammoniated Phosphate.	Quinnipiac Co., New York, N. Y	244
9454 9713 F 9850	Plow Brand Raw Bone Superphosphate.	Etiwan Phosphate Works, Charleston, S. C.	245
9428	Pocomoke Superphosphate	E. B. Freeman & Co., Norfolk, Va	246
9701	Premium Brand for Tobacco	Richmond Guano Co., Richmond, Va	247
9644 F 9874	Premium Dissolved Bone	Richmond Guano Co., Richmond, Va	248
9555	Progressive Farmer Guano	Virginia-Carolina Chemical Co., Richmond, Va.	249
9332	Prolific Cotton Grower	Goldsboro Oil Co., Goldsboro, N. C	250
9444	Prolific Truck Grower	Goldsboro Oil Co., Goldsboro, N. C	251
9512	Premium Tobacco Fertilizer	Richmond Guano Co., Richmond, Va	252
F 9910	Pure Acid Phosphate	Imperial F'rtil'zer Co., Charleston, S.C	253
F 9870	Pure Bone Meal	Navassa Guano Co., Wilmington, N. C	254
9693	Purity Guano	Lazaretto Guano Co., Baltimore, Md.	255
9335	Raleigh Standard Guano	North Carolina Cotton Oil Co., Raleigh, N. C.	256
9460 F 9865	Rasin Acid Phosphate	Rasin Fertilizer Co., Baltimore, Md.	257
9445	Raw Bone Superphosphate for Tobacco.	Virginia-Carolina Chemical Co., Richmond, Va.	258
9568	Rawlins' Favorite Tobacco Guano.	Columbia Guano Co., Norfolk, Va	259
9579	Reese's Pacific Guano	Jno. S. Reese & Co., Baltimore, Md	260
9452	Red Bull Fertilizer	Darlington Phosphate Co , Darlington, S. C.	261
9626	Reidsville Acid Phosphate	Reidsville Fertilizer Co., Reidsville, N. C.	262
9522	Richmond Brand Guano	Virginia-Carolina Chemical Co., Richmond, Va.	263
9621	Royal Fertilizer	Reidsville Fertilizer Co., Reidsville, N. C.	264
9573	Royster's Bone and Potash Mixture.	F. S. Royster Guano Co., Tarboro, N. C	265
9459 F 9842	Royster's High Grade Acid Phosphate.	Virginia-Carolina Chemical Co., Richmond, Va.	266
F 9844	Royster's XX Acid Phosphate	F. S. Royster Guano Co., Tarboro, N. C	267

NOTE. **F 9870—Total phosphoric acid in pure bone meal is valued at 3 cents per pound.**

	Place where Sample was taken, and Mechanical Condition of Fertilizer. (See page 11.)	Water.	Insoluble Phos Acid.	Soluble Phos. Acid.	Reverted Phos Acid	Available Phos. Acid.		Nitrogen.	Equivalent to Ammonia.		Potash.		Relative Seaboard Value per ton of Unmixed Ingredients.	
						Found.	Guaranteed,		Found.	Guaranteed.	Found.	Guaranteed.	Guaranteed.	Found.
													$	$
237	Lexington *n*	17.35	1.55	5.60	4.88	10.48	10	---	---	----	2.01	2	10.00	10.39
238	Wadesb'ro *n p*	13.98	2.28	8.88	1.04	9.92	8	2.18	2.65	2½	1.33	1	13.40	15.63
	Wadesboro *n*	12.60	2.39	8.19	1.55	9.74		2.47	3.00		1.39			16.39
239	Dunn *d*	11.91	0.99	7.42	2.90	10.32	8	2.25	2.73	2	2.28	1½	12.70	17.09
240	Stoneville *d*	12.13	1.71	6.09	2.86	8.95	8	2.21	2.68	2	2.66	2	13.20	16.25
241	Monroe *d*	9.29	2.98	6.73	2.65	9.38	8	1.74	2.11	2	1.12	1	12.20	13.69
242	Kinston *d*	11.50	1.61	6.51	3.27	9.78	8	2.07	2.51	2½	3 00	3	15.40	16.85
243	Washington *n*	9.95	2.00	3.35	2.89	6.24	5	2.34	2.84	3	6.03	6	17.20	17.84
244	Elm City *n*	15.16	2.14	7.27	1.69	8.96	8	2.06	2.50	2¼	1.12	1	12.80	14.28
245	Wadesboro *n p*	13.07	3.65	7.89	1.14	9.03	8	2.59	3.14	2½	1.71	1	13.40	16.47
	East Bend *n*	12.37	2.23	8.00	2.24	10.24		2.47	3.00		1.70			17.10
	Cherryville *n*	14.96	2.58	7.98	2.12	10.10		2.06	2.50		1.61			15.69
246	Washington *n*	13.89	1.60	7.05	2.40	9.45	8½	1.93	2.34	2	1.84	1½	13.10	15.02
247	Winston *d*	14.49	0.97	6.54	4.55	11.09	8	1.74	2.11	2	2.66	2	13.20	16.60
248	Elkin *n*	14.82	1.43	10.43	3.75	14.18	13	---	---	----	----	----	10.40	11.34
	N. Wilkesb'o *n*	13.20	0.51	9.63	5.98	15.61		---	-	----	---	--		12.49
249	Clinton *d*	17.44	1.19	6.41	2.51	8 92	8	1.79	2.17	2	1.61	1½	12.70	13 95
250	Goldsboro *d*	12.42	0 91	7.01	2.72	9 73	9	2 20	2.67	2½	2.87	2	15.20	17.06
251	Burgaw *d*	11.31	0 82	5.99	1.52	7.51	7	3.17	3.85	4	7.04	7	22.20	22 29
252	Rocky Mo'nt *d*	13.24	1.10	6 32	1.61	7.93	8	1.76	2.14	2	2 83	2	13 20	14.31
253	Albemarle *n*	15.26	1 45	10.40	3 45	13.85	12	-	--	---	---	----	9.60	11 08
254	Winston *s*	6.37	See	foot	not	e.		4 18	5.07	3½	----	----	15 00	23.87
255	Scotland N'k *n*	9 81	1.30	6 59	2.36	8 95	9	2.17	2 63	2½	1.93	1	14.20	15.40
256	Kinston *r*	12.80	1.38	6 40	2 40	8 80	8	2.55	3.10	2¾	2.25	2	15.00	16 73
257	Monroe *n*	13.09	1.38	12.93	3 04	15.97	14	---	---	----	---	----	11.20	12.77
	Reidsville *n*	12.63	0.41	12.49	3.83	16 32		---	---	----	---	--		13 06
258	Laurinburg *d*	12.45	0.90	8.01	1.93	9.94	9	2.17	2 63	2½	1.87	1½	14.70	16.13
259	Battleboro *d*	13.32	1.46	6 31	3 21	9 52	9	3.30	4 01	3½	4.61	4½	20.10	21.85
260	Louisburg *d*	14.45	1.24	3.24	5.75	8 99	8½	1.52	1.85	2¼	1.78	1.20	13.40	13 41
261	Rockingham *n p y*	14.28	1.93	8.52	1.29	9 81	8	2.47	3 00	3	2.01	2	15.60	17 06
262	Kernersville *n*	15 04	2 09	11.53	2 28	13 81	12			----	---	----	9.60	11 05
263	Dunn *n*	15.75	1.19	7 04	2 52	9.56	8	1.76	2.14	2	1 10	1	12 20	13.89
264	Reidsville *n*	13.28	1.74	8.06	2.02	10 08	8	1.42	1.72	2¾	3.30	2¾	15 75	15.49
265	Roxboro *n*	14.30	0 14	6.37	2 42	8.79	8	---	---	---	1.95	2	8.40	8 98
266	Monroe *n*	16.55	1.39	10 59	3.15	13.74	12	---	---	----	----	--	9.60	11 00
	Lenoir *n*	13.01	2.38	10.18	3 30	13 48		---	---	----	---	--		10 78
267	Hickory *n*	14 01	0 26	8.79	3 74	12.53	12	---	--	--		--	9.60	10 03

11 per cent is guaranteed, 19.50 per cent is found.

Station Number.	Name of Brand.	Name of Manufacturer.	
9642	Ruckett's Acid Phosphate	Virginia-Carolina Chemical Co., Richmond, Va.	268
9362	Sea Fowl Guano	Bradley Fertilizer Co., Boston, Mass.	269
9367	Sea Gull Ammoniated Guano	Patapsco Guano Co., Baltimore, Md	270
9392	Slingluff's Pure Dissolved Bone for Home Fertilizers.	Boykin, Carmer & C., Baltimore, Md	271
9348	Special Bright Tobacco Manure	Armour Fertilizer Works, Chicago, Ill	272
9485	Special Compound for Cotton, Corn, Peanuts and Grain.	F. S. Royster, Tarboro, N. C	273
9561	Special Compound for Cotton, Corn, Peanuts and Grain.	F. S. Royster, Tarboro, N. C	274
9571	Special Plant and Truck Fertilizer.	Virginia-Carolina Chemical Co., Richmond, Va.	275
9374	Special Potato Grower	Griffith & Boyd, Baltimore, Md	276
9488	Special Seven Per Cent for Potatoes and Early Truck.	Imperial Guano Co., Norfolk, Va	277
9373	Special Strawberry Guano	Griffith & Boyd, Baltimore, Md	278
9395	Special Three Per Cent Guano	Charlotte Oil & Fertilizer Co., Charlotte, N. C.	279
9360	Spring Crop Grower	Griffith & Boyd, Baltimore, Md	280
9359	Stable Manure Substitute	Griffith & Boyd, Baltimore, Md	281
9455	Standard Cotton Fertilizer	W. C. MacMurphy & Co., Charleston,	282
9559	Standard Dissolved S. C. Bone	Virginia-Carolina Chemical Co., Richmond, Va.	283
F 9886	Standard High Grade Dissolved Bone.	Standard Fertilizer Manufact'ng Co., Charleston, S. C.	284
9438	Standard Fertilizer, Lister's Success.	Lister's Agricult'al Chemical Works, Newark, N. J.	285
F 9836	Standard Raw Bone Soluble Guano.	Virginia-Carolina Chemical Co., Richmond, Va.	286
F 9896	Standard Wheat Grower	Standard Fertilizer Manufact'ng Co., Charleston, S. C.	287
9583 F 9855	Staple Acid Phosphate	Caraleigh Phosphate & Fertilizer Works, Raleigh, N. C.	288
9403 F 9849	Star Brand Guano	Virginia-Carolina Chemical Co., Richmond, Va.	289
9420	Star Brand Special Tobacco Manure.	Virginia-Carolina Chemical Co., Richmond, Va.	290
9372 F 9866	Sterling High Grade Acid Phosphate.	Caraleigh Phosphate & Fertilizer Works, Raleigh, N. C.	291
9380 F 9887	Stonewall Brand Acid Phosphate.	Virginia-Carolina Chemical Co., Richmond, Va.	292
9396	Stonewall Brand Guano	Virginia-Carolina Chemical Co., Richmond, Va.	293
9480	Stonewall Guano	Virginia-Carolina Chemical Co., Richmond, Va.	294
9350	Stonewall Tobacco Fertilizer	Virginia-Carolina Chemical Co., Richmond, Va.	295
9520	Stono Acid Phosphate	Stono Phosphate Works, Charleston, S. C.	296
9524	Stono Complete Fertilizer	Stono Phosphate Works, Charleston, S. C.	297
9545	Tatum's High Grade Mixture	Navassa Guano Co, Wilmington, N. C	298

	PLACE WHERE SAMPLE WAS TAKEN, AND MECHANICAL CONDITION OF FERTILIZER. (See page 11.)	Water.	Insoluble Phos Acid	Soluble Phos. Acid.	Reverted Phos Acid	Available Phos. Acid.		Nitrogen.	Equivalent to Ammonia.		Potash.		Relative Seaboard Value per ton of Unmixed Ingredients.	
						Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.	Guaranteed.	Found.
													$	$
268	North Wilkesboro *n*	13.18	1.23	8 96	2.72	11.68	10	---	---	----	----	----	8.00	9.34
269	Fayetteville *n*	15.39	2.70	6.81	3.00	9.81	9	1.85	2.25	2¼	1.04	1	13.60	14.29
270	Selma *n*	11.38	1.24	6.68	2.66	9.34	9	1.71	2.08	2	1.62	1½	13.50	14.08
271	Maxton *n*	11.74	1.48	8.26	2.68	10.94	12	2.28	2.77	2	----	...	14.40	15.40
272	Newbern *d* ...	5.35	5.49	1 97	5.69	7.66	6	6.06	7.36	7	8.96	7	28.60	32.75
273	Dunn *r*	15:64	1.82	5.59	2.82	8.41	8	1.89	2.29	2	2.10	1	12.20	14.32
274	Monroe *d*	16.20	1.02	3.76	4.55	8.31	8	2.06	2 50	2	1.89	1½	12.70	14.54
275	Newbern *r* ...	13 64	1.36	6.26	2.38	8.64	8	4.54	5.51	5	3.02	3	21.40	23.15
276	Fayetteville *d*	11 20	1.48	8.47	2.18	10.65	8	5.77	7.00	8	5.85	6	31.60	31.17
277	Williamston *d*	10.31	1.85	4.00	2.96	6.96	7	5 78	7.02	7	6.08	5	27.40	28.50
278	Fayetteville *n*	11 04	1.57	5.88	2 53	8.41	10	3.40	4.13	4	4 32	3	20.60	20.96
279	Maxton *n*	14.63	0.20	6.46	2.00	8.46	8	2 60	3 16	3	1.45	1½	15.10	15.80
280	Fayetteville *d*	11.60	1.93	7.07	2.16	9.23	8	1.62	1.97	2	4.57	4½	15.70	16.68
281	Fayetteville *r*	11.14	1.93	7.28	2 33	9 61	8	3 04	3.69	3½	4.07	4	18.80	20.61
282	Wadesboro *d*.	11 66	3.57	5 88	2.86	8 74	8	2.49	3.02	2½	1.67	1	13.40	15.91
283	Elizabeth City *n*	14.22	0.87	10.78	3.18	13.96	13	---	---	----	----	----	10 40	11.16
284	Pilot Mt. *n* ...	13.84	1.45	10.13	3.64	13.77	13	---	---	--	----	----	10.40	11.01
285	Laurinburg *n*	15 11	2.60	7.25	1.42	8.67	8	1.81	2.20	2	2.15	2	13.20	14.36
286	Lattimore *d* ..	13.55	2.94	5.62	3.41	9.03	8	1.69	2 05	2	1 39	1	12.20	13.54
287	Pilot Mt. *n* ...	12.55	1.06	3.57	8.11	11.68	10	---	---	--	2.87	2	10.00	12.21
288	Concord *n*	10.10	2.58	5.78	4 22	10 00	10	---	---	--	---	---	8.00	8.00
	Statesville *d* ..	13.64	2 46	6.65	4.76	11.41		---	---	----	----			9.13
289	Nashville *n* . .	15.98	1.52	6.23	3.51	9.74	8	2.01	2.44	2	1.26	1¼	12.45	14.91
	Cherryville *d*.	14.27	3 02	6 87	1.98	8.85		1.95	2.37		1.59			14.36
290	Greenville *n* ..	15.49	1.97	7.92	2.40	10.32	9	2.47	3.00	2¾	1.38	1½	15.30	16.84
291	Fayettev'le *np*	14.95	0.92	11.55	2.93	14.48	13	---	---	----	----	----	10.40	11.58
	Greensboro *n*	13.61	1.45	9.40	3.91	13.31		---	---	--	----	----		10.65
292	Maxton *n*	13.36	1.27	7.00	3.93	10.93	10	---	---	----	----	----	8.00	8.75
	Waln't Cove *n*	9.12	2.17	4.50	5.36	9.86		---	---	----				7.88
293	Maxton *d* ...	13.22	1.75	6.55	3.02	9.57	8	1.74	2.11	2	2.07	2	13.20	14.79
294	Williamston *d*	18.11	1.33	6.50	2.21	8.71	8	1.66	2.02	2	2.17	2	13.20	13.98
295	Newbern *d* ...	12.50	1.29	6.08	3.07	9.15	8	1.87	2.27	2	2.44	2	13.20	15.21
296	Waxhaw *n* ...	13.55	1.37	11.48	3.51	14.99	12	---	---	..	----	-	9.60	11.99
297	Waxhaw *n* ...	15.91	2.05	8.11	2.06	10.17	8	2.13	2.59	2	1.23	1	12.20	15.58
298	Hasty *d*	12.59	1.28	6.12	2.26	8.38	8	2.82	3.42	3	2.00	1	14.60	16.91

Station Number.	NAME OF BRAND.	NAME OF MANUFACTURER.	
9351	Tinsley's Cabbage Manure	Virginia-Carolina Chemical Co., Richmond, Va.	299
9349	Tinsley's Irish Potato Guano	Virginia-Carolina Chemical Co., Richmond, Va.	300
9605	Tinsley's Powhatan Corn Guano.	Virginia-Carolina Chemical Co., Richmond, Va.	301
9709	Tinsley's Tobacco Fertilizer	Virginia-Carolina Chemical Co., Richmond, Va.	302
9710	Townsend's Special Tobacco Manure.	Powers, Gibbs & Co., Wilmington, N.C	303
9566	Travers' Seven Per Cent Trucker.	Virginia-Carolina Chemical Co., Richmond, Va.	304
9427	Trucker's Favorite	Lazaretto Guano Co., Baltimore, Md.	305
9569	Trucker's Special Seven Per Cent Guano.	Baltimore Guano Co., Baltimore, Md	306
9470	Truck Farmers' Special Guano	Powers, Gibbs & Co, Wilmington, N.C	307
9497	Upchurch & Earl's Special Tobacco Guano.	Powers, Gibbs & Co., Wilmington, N.C	308
9640	Valley of Virginia Bone Phosphate.	Virginia-Carolina Chemical Co., Richmond, Va.	309
9557	Vick's Acid Phosphate	Powers, Gibbs & Co., Wilmington, N.C	310
9543 9575	Vinco Guano for Tobacco	Virginia-Carolina Chemical Co., Richmond, Va.	311
F 9856	Virginia-Carolina Chemical Co.'s Acid Phosphate (ten per cent).	Virginia-Carolina Chemical Co., Richmond, Va.	312
F 9908	Virginia-Carolina Chemical Co.'s Acid Phosphate (thirteen per cent).	Virginia-Carolina Chemical Co, Richmond, Va.	313
F 9898	Virginia-Carolina Chemical Co.'s Acid Phosphate with Potash.	Virginia-Carolina Chemical Co., Richmond, Va.	314
9482	Virginia Truckers	Virginia-Carolina Chemical Co., Richmond, Va.	315
9443	Walker's Ammoniated Phosphate.	Joshua Walker, Baltimore, Md	316
9518	Wando Acid Phosphate	Wando Phosphate Co., Charleston, S. C.	317
9547	Wando Fertilizer	Wando Phosphate Co., Charleston, S. C.	318
9521	Wando Soluble Guano	Wando Phosphate Co., Charleston, S. C.	319
9418	Wilcox, Gibbs & Co.'s Manipulated Guano.	W. C. MacMurphy & Co., Charleston, S. C.	320
9584	Zell's Ammoniated Bone Superphosphate.	Zell Guano Co., Baltimore, Md	321
9653	Zell's Special Compound for Tobacco.	Zell Guano Co., Baltimore, Md	322

	Place where Sample was taken, and Mechanical Condition of Fertilizer. (See page 11.)	Water.	Insoluble Phos Acid	Soluble Phos. Acid.	Reverted Phos Acid	Available Phos. Acid.		Nitrogen.	Equivalent to Ammonia.		Potash.		Relative Seaboard Value per ton of Unmixed Ingredients.	
						Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.	Guaranteed.	Found.
													$	$
299	Newbern *r*...	8.40	2 61	2 69	3.28	5.97	6	5.44	6.60	6	7.23	6	25.20	27.84
300	Newbern *r*...	8 63	2.76	3.48	3.23	6 71	6	4.98	6.05	6	6.53	6	25.20	26.42
301	Graham *n* ...	19.82	1 25	6.77	2.84	9.61	8	1.65	2 00	2	1.11	1	12.20	13.60
302	Dunn *d*......	7.95	2.29	5 14	2 96	8.10	8	3.24	3 93	4	2.96	2½	18.50	18.87
303	Burlington *d*.	10 00	3.94	5.63	2 90	8.53	8	2.17	2.63	2½	2.63	2	14.40	15.77
304	Elizabeth City *r*	9.96	2.60	3.97	2.99	6 96	6	5.77	7.00	7	5.13	5	26.60	27.49
305	Washington *d*	9 90	2 28	4.75	2.42	7 17	7	5.66	6.87	7	5.34	5	27.40	27.57
306	Elizabeth City *n*	11.70	0.87	7.22	2 14	9.36	7	5.37	6.52	7	4.82	5	27.40	27.96
307	Rocky Point *d*	10 65	1 80	6 75	2.61	9.36	8	3.51	4.26	4	5.37	5	21.00	23.08
308	Springhope *n*.	10.87	2 76	6 72	3.10	9.82	8	2.17	2.63	2	2.14	2	13.20	16.31
309	Elkin *n*......	13 94	2 06	12.46	2.72	15 18	14	---	-	---	----	...	11.20	12.14
310	Wilson *n*. ...	15 41	2 10	9 90	3 25	13 15	12	-	---	.	----	....	9.60	10 52
311	Rowland *r*...	18 54	1 47	7 56	2 33	9 89	8½	1.98	2.40	2	1.48	1¼	12.85	15.15
	Roxboro *d*...	15.84	0.93	7 27	2.29	9.56		1.79	2.17		1.48			14.34
312	Statesville *n*..	13.01	3.75	6.47	3.40	9.87	10	---	--	----	---	----	8.00	7.89
313	Lexington *n* .	16.55	1.94	7.92	4.90	12 82	13	--	--	----	----	..	10.40	10.26
314	Waln't Cove *d*	15 57	0.84	8.42	3 07	11 49	10	--	---	---	1.92	2	10.00	11.11
315	Williamston *d*	9.84	1 88	6 32	1 59	7.91	8	3.92	4.76	5	5 95	5	23.40	23.71
316	Clinton *r*.....	15.06	3.01	6 45	2.64	9.09	8	2.12	2.57	2.43	1.93	1½	13.73	15.27
317	Waxhaw *d*...	12.88	1.96	11.50	1.96	13.46	12	---	---	----	--	...	9.60	10.76
318	Fair Bluff *n*..	12.65	3.86	7.07	2.14	9.21	8	2.48	3.01	2½	1.64	1	13.40	16.24
319	Waxhaw *n*...	13.20	3.28	7 37	2.99	10 36	8	1 91	2.32	2	1.50	1	12.20	15.36
320	Maxton *d* ...	11.72	1.07	5.56	3.64	9.20	8	2.37	2 88	2½	2.72	2	14.40	16.99
321	Gastonia *n*...	15 21	2.37	7.29	2.54	9 83	8	2.03	2.46	2	1.53	1	12.20	15.29
322	Roxboro *n* ...	14 01	2.38	6.27	3 18	9 45	8	1.67	2 03	2	2 54	2	13 20	14.97

OFFICIAL FERTILIZER ANALYSES,

INCLUDING ALL ANALYSES DURING 1896.

A Warning in regard to Compost Peddlers

ISSUED BY THE
NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION
RALEIGH, N. C.

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AGRICULTURAL EXPERIMENT STATION,

AND

THE FERTILIZER CONTROL STATION

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A Warning in Regard to Compost Peddlers.

BY H. B. BATTLE, DIRECTOR.

A so-called company, under the name of the "Champion Chemical Process Company," with J. D. Butler, President and General Manager, and capital stock of $50,000, with offices stated to be at Dunn, Fayetteville, and Thomasville, N. C., has recently been operating in the State. This bulletin is issued to warn the people of North Carolina against this company, or any similar concern operating on the same basis. The circular distributed by this company is as follows:

CHAMPION CHEMICAL PROCESS COMPANY,
Dunn, Fayetteville, and Thomasville,
North Carolina.
J. D. Butler, Pres. and Gen'l Manager.
Capital Stock, $50,000.
Perfect Satisfaction Guaranteed.

Chemicals and amounts used per ton:
12 per cent. of commercial saltpeter.
12 per cent. of Murate sulphate of ammonia.
12 per cent of Murate sulphate of potash.
100 lbs. Sulphate of lime and sulphuric acid.
20 lbs. Sal soda and Murate sulphate of soda.
2 bushels of sulphate of salt.

Composted with rich dirt, or swamp mud, or surface, four weeks before using and keep dry, putting down a layer of chemicals and a layer of dirt till chemicals are consumed.

This is to certify that I, ... have this day purchased of the above company the right to the membership of the Champion Chemical Process Association, which entitles me to the chemicals at $4.00 per ton or enough to make a ton, and this right is good for a life time.

This the .... day of ...., 189 .
Agent.........................

The Station has been able to obtain very conclusive evidence of the way in which this so-called company has been operating. Local agents are solicited to secure members at the rate of $4.00 each, $2.00 of which goes to the company, and $2.00 the local agents retain. The advantage (?) accruing from membership is the purchase from certain druggists, of the chemicals mentioned in the foregoing list. The amounts stated therein, however, are misleading and erroneous, to say the least. Instead of *12 per cent.* per ton of the first three ingredients, which is the equivalent of 240 lbs. of each ingredient per ton, the amounts actually furnished, as explained later, is only *12 lbs.* of each ingredient per ton.

In reply to letters to the mayors of the three towns mentioned above, asking whether such company was operating in those towns, the following letters have been received:

THOMASVILLE, N. C., Dec. 25, 1896.

DR. H. B. BATTLE, *Raleigh.*

Dear Sir: Yours of the 23d to hand and contents noted. I know of no such firm as the "Champion C. P. Co." nor any firm engaged in the business named.

Very truly,

[Signed] J. A. ELLIOTT, *Mayor.*

FAYETTEVILLE, N. C., Dec. 22, 1896.

MR. H. B. BATTLE, *Director,*
Raleigh, N. C.

Dear Sir: Replying to yours of 18th, will say I know of no such company having office here, but I understand there is one at Dunn. I know nothing about it or the parties, however. Yours truly,

[Signed] W. S. COOK, *Mayor.*

DUNN, N. C., Dec. 21, 1896.

MR. H. B. BATTLE, *Raleigh, N. C.*

Dear Sir: Yours of the 18th inst. to hand. I know of no such company as the one alluded to in your letter. There is no such company here.

Respectfully,

[Signed] H. C. NCNEILL, *Mayor.*

The Experiment Station is of the opinion that the operation of such a business is fraudulent, and the public are hereby warned against it, for the following reasons:

(1). The quantities of the chemicals proposed to sell, according to this circular, per ton is—

12 per cent. commercial saltpeter equivalent to 240 lbs. per ton.
12 per cent. Murate sulphate of ammonia or 240 lbs. per ton
12 per cent. Murate of sulphate potash or 240 lbs. per ton.
100 lbs. Sulphate of lime and sulphuric acid.
20 lbs. Sal soda and Murate sulphate of soda.
2 bushels sulphate of salt, about equal to 160 lbs.

The above weights amount to 1,000 lbs., all of which, according to the printed statement, can be purchased for $4.00. In a private letter, however, written by the President, the actual amounts sold for $4.00 are said to be as follows, which is also verified from an independent source:

12 lbs. sulphate of potash.
12 lbs. nitrate potash.
12 lbs. sulphate of ammonia.
100 lbs. calcium oxide, [ordinary building lime.]
20 lbs. carb soda.
2 bushels chloride soda, [common salt.]

At the actual market price of these ingredients $4.00 is about an average price for the above materials, amounting to 316 lbs. instead of the 1000 lbs. as is implied in the printed circular. The words used in the circular, "*Murate Sulphate of Ammonia, Murate Sulphate of Potash, Murate Sulphate of Soda, Sulphate of Salt,* have no foundation in fact, and the high sounding words are evidently used for the purpose of misleading people who do not understand the use of such terms.

(2). The materials themselves, although probably worth $4.00 for the 316 lbs. mentioned above, are of little value as a fertilizing application. The only use of these materials is to furnish potash from the sulphate of potash; nitrogen (or ammonia) and potash from the nitrate potash; and ammonia from the sulphate of ammonia. The total amount of ammonia and potash in these materials is 4.8 lbs. ammonia, and 11.1 lbs. of potash, which, at market rates for these fertilizing ingredients, amount exactly to *69 cents.* In the chemicals above there are no other fertilizing applications, and the only possible advantage from their use would be the possible effect of the calcium oxide (ordinary lime) and chloride of soda, which, when combined, might have some value in decomposing the swamp mud, etc., especially if forest leaves are mixed with the same. The only value, then, to the farmer in purchasing a membership at $4.00, and paying for $4.00 worth of chemicals would be in getting 69 cents worth of fertilizing ingredients in a ton, a trade, which in these hard times, few people can afford to make.

(3) Not only is there but little actual value in these chemicals, but the peculiar combination of the same would really result in the decomposition of a portion of them, and absolute loss of some even of the 69 cents. The addition of calcium oxide (lime) to sulphate of ammonia, especially if in a moist condition, would result in decomposing the last-named material and liberating the ammonia as a gas, which would doubtless, much of it, be lost, although some might possibly be retained in the swamp mud, etc.

Another serious defect in such a mixture is the entire absence of any form of phosphoric acid. Phosphoric acid, as is well known, forms a very important part of all complete fertilizing applications. The absence of it in such a mixture presumed to be and claimed to be a perfect combination, only shows the ignorance of the author of such a formula, and of the company or persons who palm it off for a money consideration upon those who have faith to believe in them.

(4) The following words appear immediately under the statement that the capital stock of the company is $50,000: "PERFECT SATISFACTION GUARANTEED." It is presumed that the $50,000 guarantees this satisfaction to members, at least it is hoped that this is the case. From an autograph letter of the President, now in the possession of the Station, though written to another party, the following is an exact quotation :

> Will say we want a man to solicit membership to our Company, which cost each member $4.00, and we will give you one-half of each membership you solicit. You see it costs each consumer $4.00 to become a member, and then we will furnish him the chemicals at $4.00 All we want you to do is to solicit the membership and send to ...., and then each member orders his chemicals himself from ...., our distributing agents, and they will ship it out to any member to any place instructed. The same chemicals would cost them $15.00 per ton before they become a member, and after becoming a member

$4.00, and we guarantee perfect satisfaction, or money refunded It will make as good crop as commercial guano, and we guarantee the crop not fire where it is used, and you can make from $10.00 to $15.00 per day soliciting memberships.

In the above statement, the words that "the same chemicals would cost them $15.00 per ton before they become a member, and after becoming a member $4.00," and also "guarantee perfect satisfaction," are misleading and utterly incorrect. Parties can go to almost any market where these materials are kept and buy them for $4.00, whether they are members or intend to become members, or do not intend to become members. Such parties, with the proper information, would never think of buying $4.00 worth, when in reality the total agricultural value to them would be 69 cents or less. The next statement in the above is the following: "It will make as good crop as commercial guano." It is not stated whether the $50,000 is behind this statement, but it may be presumed that it is so. In a ton of commercial guano of the usual percentages there are

160 lbs. actual available phosphoric acid.
50 lbs. actual ammonia.
30 lbs. actual potash.

These ingredients alone contain $13.90 worth of fertilizing ingredients against 69 cents of the "guaranteed" value of the above company. As to the crop which will be made being equal to that made by commercial guano, it can positively be said that, under the same conditions, it is utterly impossible. If any farmer has ever gotten as good results as from commercial guano it was certainly not due to the use of these chemicals in the quantities stated.

There is another opinion to consider, outside of the fact that the materials sold are worth almost next to nothing, and this is the result of the crop which a farmer has a right to expect to be good and remunerative, from the care and expense which he has taken. He will find that the loss of this crop, or a considerable portion of it, will be far more than his loss in paying for the chemicals that are of little or no value to him for the purpose of fertilizing.

Conclusions.

The farmers of the State are urgently advised not to pay any money for fertilizing formulas, as the Station is ready and willing to suggest any mixture for any crop, using any materials at hand, or most convenient to be had. It has in the past distributed many hundreds of these formulas, and is distributing them every day. These formulas are sent entirely free, and are made up in proportions that are known to be correct, not only from a scientific but a practical standpoint. Of what earthly use is it to buy from a man, at a high price, a set of figures, which nine times out of ten, is incorrect, and even if correct, could be had by application to the Station without cost? The Experiment Station has now in preparation, and will shortly issue, a Station Bulletin on the subject of composts and fertilizing formulas, which will be distributed in time for preparation of home mixtures for the coming crop. A copy of this Bulletin will be sent to any party in North Carolina who may request it.

After an experience of twenty years, the Station can confidently advise the people of the State to stop buying so-called formulas that are in almost all cases entirely worthless. In their place it can recommend mixtures, the proportions of which can be had without charge, whenever any party desires to ask for them.

The San José Scale
in North Carolina

ISSUED BY THE
NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION
RALEIGH, N. C.

BULLETIN NO. 138

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N. C. COLLEGE OF AGRICULTURE AND MECHANIC ARTS.

THE NORTH CAROLINA

AGRICULTURAL EXPERIMENT STATION,

AND

THE FERTILIZER CONTROL STATION

UNDER THE CONTROL OF THE

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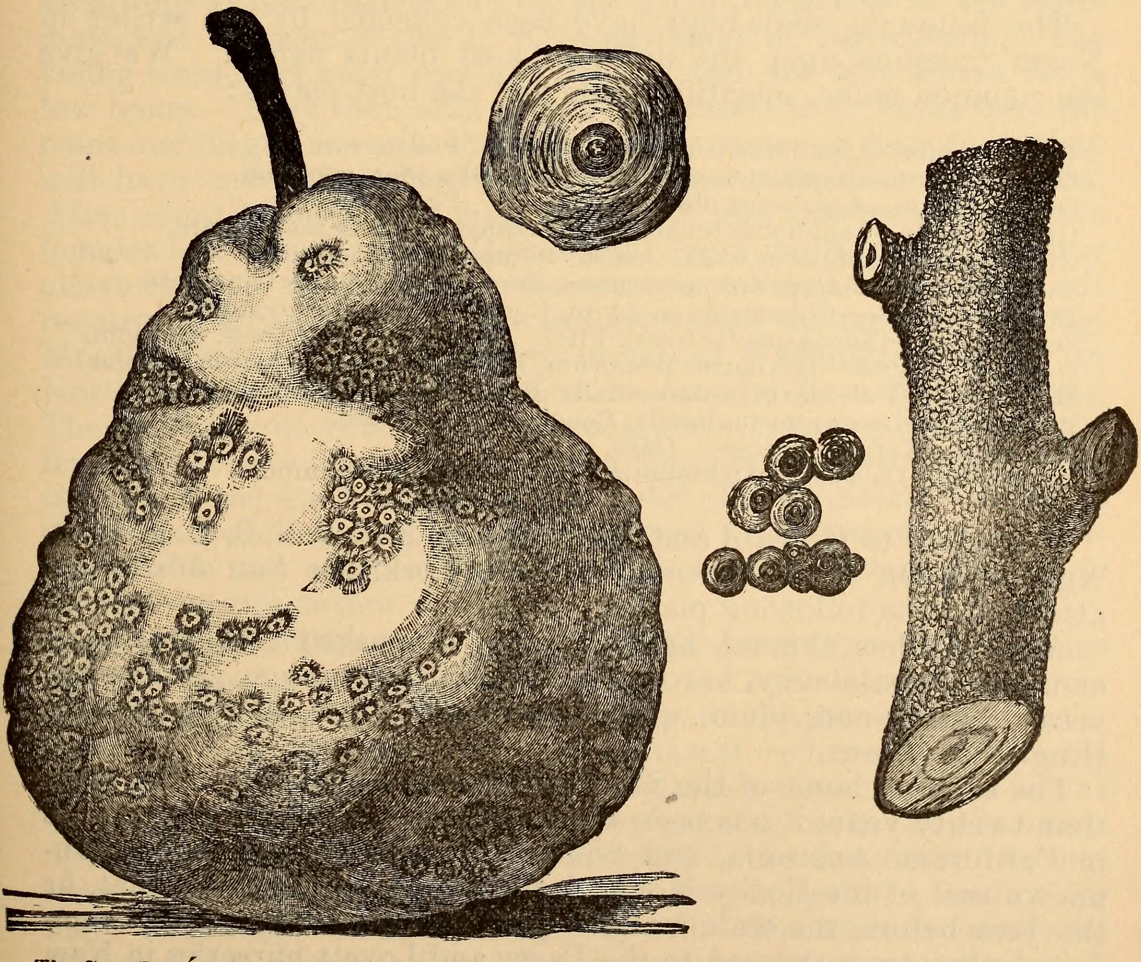
RALEIGH, N. C.

The San José Scale in North Carolina.

By Gerald McCarthy, Entomologist.

The San José scale, *Aspidiotus perniciosus*, has reached North Carolina, and is now a grave menace to the future of orchard culture in this State.

This insect being itself very small and inconspicuous. and a new comer to this side of the continent, is not very well known to fruit growers. Most every one has seen the common oyster shell scale of the apple and other trees, and the very common scale of the Enonymus or staff tree. All these, and many more scales, belong to one and the same order of insects, namely, the *Hemiptera* or half-winged bugs. The scale-bugs form a very distinct family of this order called the *Coccidœ*. Besides the scale-bugs, this family includes the mealy-bugs, so troublesome to plants indoors.



The San José Scale, showing infested pear and twig; also male and female scales magnified. (Howard, Ent. Div. U. S. Dept. Agr. Year Book, 1894, p. 268.)
]

In temperate climes, the entire family are dangerous enemies of plants and noxious to humanity, but in the tropics one species of coccus produces the dye stuff valued as cochineal in the arts and sciences. Another species produces the shellac of commerce.

Prof. J. H. Comstock, who is the American authority on this family, thus describes it: "The females never possess wings; the males are winged in the adult state, but possess only a single pair of wings, having no mouth, it does not consume food." In all our species of scale-bugs, the young and females are covered by a waxy shield or scale, composed partly of wax and partly of the cast off or molted skins of the growing insect. They have when hatched six legs and a pair of antennæ, or "feelers." The young run about freely for a few hours after birth, but soon select a spot, settle down, and the females never afterwards leave it. After molting their first skin, the females lose their legs and feelers, and in fact become merely animated mouths and stomachs. In the genus *Aspidiotus*, to which the San José scale belongs, the female scale is circular, the center is a brownish or yellowish dot, surrounded by a darker ring, and this again by a whitish ring. The diameter of the San José female scale is about $\frac{1}{10}$ inch. The male scale is smaller and more elongated, and is blackish in color. The eggs are white, but are never oviposited—they hatch within the body of the mother.

The following scale-bugs have been collected by the writer in North Carolina upon the different host plants named. We give the common name, scientific name and the host plants:

Convex scale—Aspidiotus convexus, Comst. Peach, rare
Oleander scale—Aspidiotus nerii, Bouché. Oleander, common.
Obscure scale—Aspidiotus obscurus, Comst. Peach, rare.
Gloomy scale—Aspidiotus tenebricosus, Comst. White maple, rare.
Grape scale—Aspidiotus uvae, Comst. Grape vine, common.
San José scale—Aspidiotus perniciosus, Comst. Deciduous fruits, etc.
Enonymus scale—Chionaspis enonymi, Comst. Staff tree, common.
Scurfy scale—Chionaspis furfurus, Fitch. Apple and pear trees, common.
Oyster-shell scale—Mytilapsis pomorum, Bouché. Apple, pear and poplar.
Maple scale—Pulvinaria innumerabilis, Rath. Maple, common.
Plum scale—Lecanium juglandis, Bouché. Plum, rare.
Oak scale—Kermes, species. Oaks, rare.
Mealy Bug—Dactylopius adonidum. Indoor plants, common.

According to Howard and Marlatt (Div. Ent. Bull. 3, U. S. Dept. Agr.) and Dr. A. J. Lintner, of New York, the San José scale attacks all the following plants:

Acacia, alder, almond, apple, cherry, cotoneaster, currant, elm, enonymus, gooseberry, hawthorn, linden osage orange, peach, pear, pecan, persimmon, plum, quince, raspberry, rose, spiræa, walnut (English), willow.

The original home of the San José scale is not known. For more than twenty years it has been known and dreaded by fruit growers in California, Australia, and South America. It was wholly unknown east of the Rocky Mountains previous to 1887. In that, or the year before, the scale was brought from California upon some Japan plum trees shipped to the Parry and Lovett nurseries in New

Jersey. From these two centers it has been disseminated over all the Eastern States. The following list of infected States is compiled from Howard and Marlatt, and other sources: Alabama, Arizona, California, Delaware, Florida, Georgia, Idaho, Indiana, Illinois, Louisiana, Massachusetts, Maryland, New Jersey, New York, New Mexico, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina (?), Tennessee (?), Virginia, Washington, West Virginia, British Columbia. Although actively combated since 1893 in the States bordering the Atlantic, it is now more widespread than ever, and will probably remain with us permanently as one of the pests to be restrained but never extirpated by the fruit grower.

Life History.—The San José scale, as has been said, is a member of the Order Hemiptera or bugs. It differs from most other genera of this Order in that the males undergo a complete metamorphosis, and when mature have only one pair of wings. The male and female insects pass the winter beneath their waxy scales as young. About the time the peach buds begin to swell, the young awake and resume their growth, which is soon completed. The male then emerges and fertilizes the female, which soon begins to give birth to living young instead of eggs. The young continue to be born for about 6 weeks at the rate of about 2 dozen per day, according to the observations of Mr. Theo. Pergande of the Entomological Division of the U. S. Department of Agriculture. The young scale-bugs have legs and feelers, and are very active for a few hours. They then affix themselves, insert their beaks into the plant and begin to suck the sap. After three or four days, they will have covered themselves with a waxy scale like the parent. After about 12 days they molt their skin, legs and feelers, and the females lose their eyes. After several more molts, extending over about 25 days, the males become mature and quit their scales. It requires nearly 40 days for the full growth of the female scale bug. Mr. Pergande found 4 successive broods at Washington, D. C. In North Carolina and southward, there may be from 5 to 7 broods. The fecundity of this insect is prodigious. Starting with a single fertilized female in spring, if all the increase live, we may have at the end of the 4th brood more than 3,000,000,000 insects. Being so very small while young, and soon covered by a hard, waxy scale, it is probable that most of the scale-bugs born do live when left to themselves and nature.

Methods of Dissemination.—As the males alone possess wings and the females actually use their legs for only a few hours after birth, this insect would seem not likely to spread rapidly. Such, however, is not the case. No noxious insect we have spreads faster than this. The scales are carried from tree to tree upon the feet of birds and bodies of other insects, upon pruning tools, and the hands of fruit gatherers. So certain and rapid is the dissemination, that starting with a single scale on a single tree in spring a hundred or more trees may be badly infested by fall. The scale is usually introduced into new localities upon nursery stock, scions or buds.

Natural Enemies.—It is a fortunate and beneficial law of nature that most predacious and parasitical animals have enemies of their own kind. In the case of the San José scale we find this rule to hold good. The tribe of little Lady-beetles or "Lady-bugs," which are such inveterate enemies of unscaled plant lice, include two or more species which prey upon the San José and other scale-bugs. These are the twice-stabbed Lady-beetle, *Chilochorus bivulnerus*, and the black Lady-beetle *Pentilia misella*. Both species are common in North Carolina. Fruit growers should learn to recognize these friendly little insects and forbear to harm them when seen on fruit trees. These beetles have a keener scent for scale bugs than most orchardists, and when they are found upon fruit trees the presence of San José or other scale bugs may be suspected.

The twice stabbed Lady-beetle is about $\frac{1}{6}$ inch long, jet black, with two yellowish spots on the back. Its form is oval. The black beetle is also oval, but only about $\frac{1}{15}$ inch in length, and has no spots. The larvæ or young of both beetles resemble very small alligators and are larger and longer than the parent insect. Several minute parasitic insects of the order *Hymenoptera* and family *Chalcididæ* prey also upon this scale. But after all is told, the amount of help given by the natural enemies of scale bugs is so small that it must for the present at least be ignored. The orchardist must depend upon himself and the remedies science has placed at his command. Hereafter "eternal vigilance" will be the price of fruit.

Remedies.—In California where this insect first became a dangerous orchard pest, the favorite remedies are fumigating with hydrocyanic acid gas, and spraying during the winter season with a combination of sulphur, salt, and lime, or a solution of soda, rosin and fish oil. The gas treatment is effective but dangerous, difficult and expensive as regards trees in orchard. It cannot be thoroughly and satisfactorily carried out in a large way by any one except a professional, with some ability as an engineer. Most of the California washes have all been tested by the U. S. Department of Agriculture at Washington, D. C., but nothing save a strong solution of whale-oil soap has been found fully satisfactory under all circumstances.

Experimental Tests.—In North Carolina, we have conducted the following experiments, November 23, 1896, in an orchard containing pear, peach, plum, apple, and cherry trees, all badly infested. All the trees in this orchard were first cut back to the main branches and all small twigs removed. On the average $\frac{1}{2}$ the wood of 10-year-old peach trees was cut away and burned.

Experiment No. 1.—One row of 10 trees was sprayed with hot solution of whale oil soap made as in formula No. 1, at rate of 2 lbs. soap to 1 gallon of water. Result: Destruction of about 95 to 98 per cent of the scales. The treatment seemed very effective. In three hours after applying, the previously hard scales were seen bleached out, transparent and lifeless. But after an interval of about three weeks a very thorough search showed that when the scales had been massed thickly the solution had in some cases failed to penetrate and kill every scale. On the average as nearly as we could judge without actually counting the scales, a task practically impossible in an orchard, there were left alive from 2 to 5 per cent of the scales. A second treatment, which will be given in the spring, is calculated to completely destroy the insects which escaped the first application.

Experiment No. 2.—One row of 11 trees, same varieties as No. 1, were scrubbed with a common hand scrubbing-brush, using the same solution as in No. 1. Result: Only from 70 to 80 per cent (estimated) of the scales were destroyed after the same interval as before. We expected better results from scrubbing than from spraying, as it was thought that the stiff bristles of the brush would break up the massed scales and allow the solution to penetrate better. The scrubbing method requires less than ½ the liquid used in spraying The work was done by two men working on the same tree and carrying the liquid in wooden pails. The soap lathered very freely and did not seem to penetrate the scales as did that from the sprayer. It formed a light frothy covering to the tree until washed off by rain. In both these and all other experiments, it was found practically impossible to secure thorough work when the workmen were left to themselves. They had to be watched and frequently sent back to repeat what was first attempted. This difficulty is due, aside from the inherent incapacity or dislike of such people to do thorough work, to the crossing of small branches which shade or protect portions of others and from leaving unwetted small circles about the tip of the branch. The overpowering smell of the solution also probably helped to prevent thorough work.

Experiment No. 3.—One row of 12 trees, same varieties as the others, was sprayed with winter rosin wash (see formula No. *2*.) This liquid spread on the trees much better than the whale oil soap, did not lather or froth, and seemed to penetrate well. The trees were therefore more thoroughly wetted. Result: About 90 per cent of the scales were destroyed (estimated). From the bad reports published of this wash when used in the East, we expected little from it, and were very agreeably surprised to find it nearly as efficacious as the whale-oil soap. We had no rain for nearly two weeks after this wash was applied and it had therefore sufficient time to smother the insects. If it had rained frequently and copiously as it often does at this season in this climate, the results would probably have been different and less satisfactory. This solution acts very slowly.

Experiment No. 4.—One row, 12 trees, varieties as before, were sprayed with an emulsion made of whale-oil soap and "Rochester Sanitary Fluid," claimed to be much stronger than common carbolic acid. In making this emulsion, 1 lb. of whale-oil soap, ½ gallon of sanitary fluid and 7 gallons of water were used. Applied hot, without further dilution. Result, very poor; 50 to 60 per cent (estimated) of scales living. We might have used with better results a stronger emulsion, but as this fluid is rather expensive it was not considered practicable.

Experiment No. 5.—One row, 8 trees, same varieties as before, were sprayed with a solution of Rochester Sanitary Fluid. 1 pint to 1 gallon of water. Result, distinctly better than Experiment No. 4, but not sufficiently so to be a success. A stronger solution could no doubt be made to kill all the scales, but it might at the same time kill the tree and we did not attempt it. It would also be too expensive for ordinary use.

Experiment No. 6.—One row, 9 trees, same treatment as in No. 5 but diluting the solution 4 times. Result, almost negative.

Experiment No. 7.—One row 7 trees, same varieties as before. Liquid as in Experiment No. 6, applied with a scrubbing-brush. Result, very unsatisfactory.

These were all the washes considered practicable or worth trying. Subsequently we learned that in Ohio seemingly good results have been obtained by painting the infected trees with ordinary kerosene oil. Our experiments with oily or greasy applications to peach trees have so far been uniformly disastrous and we cannot recommend this treatment without further experience.

Conclusions. 1.—From our own experience and the compiled experience of others we feel justified in recommending only the whale-oil soap wash (formula No. 1) applied as a spray just after the leaves have fallen and just before the buds swell. The trees should always be severely cut back and all small twigs removed.

2.—The rosin wash (formula No. 2) will give good results if applied in the fall as above, if rain holds off for a week or more. But this cannot always be depended upon. This wash is more troublesome to make than the soap solution, but costs a little less, and is promising as a fall treatment. For spring treatment we would use only the whale-oil soap solution.

3.—At present there is no other practicable treatment that promises anything for orchard use except fumigation by hydrocyanic acid gas. This is expensive and can be undertaken only by an experienced or professional man. The gas used is extremely poisonous and the whole process is dangerous to all concerned. This gas may, however, be advantageously used to disinfect nursery stock from any and all insect pests.

What to Do with Infested Nursery Stock.—The best thing that can be done with nursery stock infested with San José Scale is to burn it root and branch. If infested to any considerable extent it is sure to be stunted, and even if freed from the scale will rarely if ever make vigorous trees. Still it can be disinfected if very thorough work is done. For this purpose, hydrocyanic acid gas must be used. The stock while dormant is heeled in to protect the roots and must not be too closely packed. A tight box, hogs-head, or tent of oiled drilling is placed over the stock. The materials should then be placed under the cover and the fumigation continue for one hour (see formula No. *3*). It must be always borne in mind that Potassium cyanide is a most deadly poison and must be kept out of the reach of children and irresponsible persons. The gas must not be breathed.

FORMULAS FOR SCALE INSECTICIDES.

Formula No. 1—Whale-Oil Soap.

Whale-Oil Soap	20 pounds.
Soft water	10 gallons.

Directions: Boil the soap in the full quantity of water, replacing that evaporated. Use hot as a fine spray. We recommend the 2d grade whale-oil soap sold by Schœllkopf, Maclagan & Hartford, 3 Cedar St., New York. Price in barrel lots 3½ cents per pound. James Good, 514 Hurst St., Philadelphia, also makes a good whale-oil soap. Price per barrel 3½ cents per pound; 50 pounds 6 cents per pound.

Formula No. 2—Winter Rosin Wash.

Common rosin	3 pounds.
Caustic soda (70 per cent) or concentrated Potash lye	1 pound.
Whale-oil or fish-oil	1 gill.

Directions: Place the above in a large kettle and cover with 3 or 4 inches of water. Boil for one hour. Stir occasionally, and replace water evaporated. When the liquid becomes dark brown, add slowly while stirring enough hot water to make 10 gallons and use at once—as hot as possible.

Formula No. 3—Hydrocyanic Acid Gas.

Fused Potassium cyanide, 58 per cent pure	1 ounce.
Commercial Sulphuric acid	1¼ fld. ounce.
Water	3 fld. ounces.

Directions: Place water in an earthen or glass dish under the covering tent or box, add the acid slowly and lastly the cyanide. The above is sufficient for 150 cubic feet of space.

Discussion of the formulas and method of applying.—We consider formula No. 1 the only one that can be depended upon in all sorts of weather. When properly made of good material and used *hot* it kills the scales in half hour or less. To make 10 gallons of this wash will cost for soap alone about 80 cents. When the trees are severely pruned before applying the wash, 1 quart will cover a large tree. The best time to apply it is just after the leaves fall and just before the buds burst.

Formula No. 2 will cost for 10 gallons about 19 cents. It is nearly as effective as No. 1 *when the weather remains dry* for several days after applying it. It must never be applied while the leaves are on the tree, but the sooner it is applied after the leaves fall the better. We recommend this as a fall wash in dry weather, to be followed if necessary by a spring application of whale-oil soap. Both these washes are very strong and are apt to kill all fruit buds, but the severe pruning will have already removed most of these buds. We repeat, this work cannot be left to common hands. Unless *thoroughly* done it is of little avail.

For general orchard use, we advise the use of a good spraying outfit. The Vermorel nozzle is best, and the fine cap only should be used.

Note.—Since the foregoing matter was prepared, most of the larger nurseries in North Carolina have been inspected by the Entomologist of the Station, and a certificate of freedom from infestation has been given to those entitled to it. In some cases, however, we have found San José Scale on stock recently shipped to nurseries in the State from Maryland and Georgia. This stock, if it had not been discovered by the Entomologist, would have been used *for propagating the tree and the scale* in these nurseries, or would have been sold to citizens of the State for planting. In all such cases the nurserymen, on learning of the nature of the pest, promptly burnt the infested stock. Yet, in the absence of any law making such inspection and destruction compulsory, we fear the pest is being continually introduced and disseminated in this way.

The State Horticultural Society, aided by the Station, has caused a bill (see below) to be introduced in the General Assembly of 1897 providing for a State Commission, with power to examine all nurseries within the State and all nursery stock coming from without, with power to quarantine, treat, or destroy all stock infested by San José Scale. In the meantime we most emphatically warn the people of North Carolina against purchasing fruit trees of any sort from irresponsible persons, or from uncertified nurseries without the State, since such stock is liable to carry the infection, and not only prove worthless to the planter, but a center of infection for the neighborhood. All stock in this State found infested by San José Scale have been, so far, traced to Georgia, Maryland and New Jersey.

[Senate Bill 243. Introduced by Senator Parker of Randolph.]

AN ACT TO PREVENT THE INTRODUCTION AND DISSEMINATION OF DANGEROUS INSECT, FUNGOUS, AND WEED PESTS OF CROPS.

The General Assembly of North Carolina do enact:

Section 1. That for the purpose of this Act the State Commissioner of Agriculture, the Director of the North Carolina Agricultural Experiment Station, and the President of the North Carolina State Horticultural Society, are hereby constituted a Commission for the extermination of noxious insects, fungous diseases and weeds which are affecting or may affect crops. They are empowered to elect one of their number chairman, and to adopt rules and regulations for their own government, such as may be requisite for carrying out the provisions of this Act. The members of the said Commission shall receive no salary, and shall be allowed only such expenses as have been specifically incurred and necessary in attending the meetings of the Commission.

SEC 2 The members of the Commission aforesaid shall hold a meeting within thirty days after the ratification of this Act, and shall prepare and publish a list of dangerous crop pests, known to be present within the State or liable to be introduced, and may at any subsequent meeting extend or amend said list The Commission shall also publish methods for exterminating such pests as they may deem capable of being economically exterminated within the boundaries of the State, and for repressing such as cannot be economically exterminated, and for preventing the spread of such pests within the State They may also adopt regulations, not inconsistent with the laws and Constitution of this State and the United States, for preventing the introduction of dangerous crop pests from without the State, and for governing common carriers in transporting plants liable to harbor such pests to and from the State, and such regulations shall have the force of laws.

SEC 3 No person, firm or corporation shall knowingly and wilfully keep upon his or their premises any plant infested by any dangerous crop pest listed and published as such by the said Commission, or permit dangerous weed pests to mature seed or otherwise multiply upon their land except under such regulations as the Commission may prescribe. Every such infested plant and premises are hereby declared a public nuisance The owner of such plants or premises shall, when notified to do so by the Commission, take such measure as may be prescribed to eradicate such pests, and if such action is not taken, or is improperly executed within ten days after being so notified, the Commission shall cause said premises to be freed from such pests by the best available method, and the cost of such work shall be a lien against such premises, and may be recovered, together with cost of action before any court in the State having competent jurisdiction Said notice shall be written, and mailed to the usual or known address, or left at the ordinary place of business of said owner or his agent. No damage shall be awarded the owner of such premises for entering thereon and destroying or otherwise treating any infested plant or crop, when done by the order of the Commission

SEC. 4. When said Commission has reason to suspect that any pest listed by them as dangerous exists in any county in the State, they shall cause such suspicion to be verified by a person competent to determine the specific identity of such pests of crops, and if such suspicion prove founded upon fact, shall further appoint, for a designated time and duty, a competent person their agent to inspect such infested premises, and to take such measures for treating the same as the Commission may direct Any duly authorized agent of the Commission shall have authority to enter upon and inspect any premises between the hours of sunrise and sunset during every working day of the year. Any one who shall seek to prevent such inspection, or who shall otherwise interfere with any agent of the Commission while in performance of his duties, shall, upon conviction, be fined not less than $5 nor more than $50 for each offence, or may be imprisoned for not less than ten nor more than thirty days

SEC. 5. For the purposes of carrying out the provisions of this Act, the sum of $500 per annum, or so much thereof as is necessary, is hereby appropriated out of any funds in the Treasury not otherwise appropriated, and shall be paid by the State Treasurer upon properly authenticated vouchers signed by the chairman of the Commission

SEC 6 The said Commission shall report to the Governor, for transmission to the next General Assembly, its acts and disbursements under the provisions of this Act Such a report, together with all such circulars as may be issued by the said Commission for the purposes of this Act, shall be printed in editions of one thousand copies by the Public Printer, and be paid for as other public printing.

SEC. 7. All laws or clauses of laws inconsistent with this Act are hereby repealed.

SEC 8. This Act shall take effect from and after its ratification.

[Copy of a paper prepared for the General Assembly.]

CROP PESTS AND THEIR DAMAGES.

Facts of Interest in Regard to the "Act to Prevent the Introduction and Dissemination of Injurious Crop Pests" now before the General Assembly.

To the Senators and Representatives of the General Assembly of 1897:

North Carolina is an agricultural State. Upon the produce of the soil the majority of our people depend. Few who have not made a particular study of such matters realize the heavy tax yearly exacted by the innumerable host of pests which prey upon our crops. Competent authorities estimate the damage by insect and fungous pests to the agriculture of the United States as not less than $400,000,000 a year. Of this sum North Carolina's proportion cannot be less than $2,000,000. Fruit growers and farmers generally who do not understand the nature of these crop parasites lay the blame for their losses on the weather and accept it as unavoidable. This is unfortunate and unwise. Noxious insects and fungi are definite organisms with fixed characters, and their increase is as much subject to natural laws as that of any other class of creatures. The weather may, by some excess, favor for a time the increase of certain classes of pests, but if the pests had not already been present in great force no damage could be done.

Science has provided us with very efficient remedies or methods for repressing these pests, but we ourselves must apply the remedies at the right time and in the right way.

Within our own memories, serious damage to most crops by insects or diseases was so rare that no one considered it. Now no one can hope to secure a good or profitable crop without constant and well-directed warfare against these pests. The truth is, the perfection of modern methods of transportation has brought down upon us within twenty-five years past nearly all the worst pests of field, orchard, and garden, from the four quarters of the globe.

Every one knows what damage the chinch bug, army worm, cotton caterpillar and tobacco-worm cause—damage that is largely preventable, if there was any central authority with knowledge to advise and power to enforce the regulations necessary to prevent the destructive increase of these pests. But bad as our common pests are, they are trifling compared with some which now threaten us. A few of these may be here named:

1.—**The Cotton-boll Weevil.** This, like the cotton catterpillar and terrapin-bug, is a native of Mexico and is progressing northward. In Texas it often does such damage that fields are not worth the picking. This insect is not yet known in North Carolina, but it may be expected.

2.—**The Gypsy Moth.** This is a European insect, introduced by an accident into Massachusetts some thirty years ago. The people, not understanding its destructive character, left it to increase at will until it become a veritable scourge. They had then either to exterminate it or give up their State. During the last six years that State has spent $675,000 in fighting it, and must spend more. Yet, had this insect been taken in hand in time it could have been exterminated for $1,000, or less. The Gypsy Moth is known to feed upon the cotton plant, and an accident may bring it to our State at any time.

3.—**The Tobacco-leaf Miner.** This is a small caterpillar closely related to the fly weevil or angoumois moth of corn. It eats out the green matter of tobacco leaves in the field, leaving the skins intact. This insect cannot be directly combated by poisoning or any other practicable method It must be fought by indirect means, such as the destruction of its food plants after tobacco has been harvested. This insect was discovered by the Experiment Station in an eastern county last year. Should it spread through the tobacco region it will do enormous damage. It is easily able to damage the crop $500,000 a year.

4.—**The San José Scale.** This is the most destructive pest known to fruit-growers. It has only recently been found in the eastern States, but has rapidly spread throughout the fruit-growing States, causing heavy damage. It was found by the Experiment Station in North Carolina last summer. and has already caused the destruction of valuable orchards. This pest is likely to cost us as much as the Gypsy Moth has cost Massachusetts, unless we take immediate and proper measures for exterminating it. The case is very urgent and delay will prove disastrous.

5.—**Peach Yellows.** This is a disease which has nearly destroyed the once famous peach orchards of New Jersey, Delaware, and Maryland. The losses caused by this disease in the above-named States must have exceeded $10,000,000. It has ruined the chief fruit interest of those States. "Yellows" is not yet known in North Carolina, but it is sure to appear at no distant day, and will, if left alone, ruin our orchards as easily as it has done those of other States. Similar to the above are Plum Knot, Apple and Pear Blight, and other fungous diseases.

The recent intrusion of the destructive San José Scale has created a panic throughout the fruit-growing States of the East. Stringent inspection and quarantine laws are being enforced by neighboring States This increases our danger, for the nursery stock condemned as suspicious or diseased in these States is liable to be shipped into our State and imposed upon our defenceless people. In self-defence we must have a law to enforce inspection, quarantine and destruction of diseased nursery stock. North Carolina cannot afford to become the dumping ground for the refuse of New Jersey, Maryland or Virginia nurseries.

The State Horticultural Society asks for the appointment of an unsalaried commission, which shall have power to enforce regulations for preventing the introduction and spread of dangerous crop pests These pests may now be numbered by the score, but any one of them is capable of doing damage to a hundred times the amount asked for as necessary to enforce the regulations of the commission. The State Board of Agriculture, at a recent meeting, endorsed the application of the Horticultural Society as contained in the bill now before the General Assembly. The Society, ever wakeful of the horticultural interests of the State, has done its full duty in calling to the attention of the representatives of the people the dangers that menace our vegetable, fruit, cotton, and tobacco-growers. To allow the pests which threaten us to have free entrance, and to multiply, will eventually entail the loss of millions. It will be folly most ruinous and little short of downright madness.

Home-mixed Fertilizers
and Composts

NOTE REGARDING BULLETIN No. 139.

This bulletin was never issued in its complete form.

N.C. AGRICULTURAL EXPERIMENT STATION
FOUNDED 1877
RALEIGH

FEBRUARY 8, 1897

Publications will be sent to any address in North Carolina upon application.

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ISSUED BY
THE NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION
RALEIGH, N. C.

BULLETIN No. 139

FEBRUARY 8, 1897

Publications will be sent to any address in North Carolina upon application.

N. C. COLLEGE OF AGRICULTURE AND MECHANIC ARTS.

THE NORTH CAROLINA

AGRICULTURAL EXPERIMENT STATION,

AND

THE FERTILIZER CONTROL STATION

UNDER THE CONTROL OF THE

N. C. STATE BOARD OF AGRICULTURE.

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RALEIGH, N. C.

Home-mixed Fertilizers and Composts.

By H. B. Battle, Director.

Introduction.—The following bulletin is issued to meet the requirements of the coming spring crop. A more complete publication will shortly be distributed. As the length of this forthcoming bulletin will not admit of its being sent to all the names on the Station's mailing list, it will be sent only to parties who request it. It is urgently advised that all interested in farming, in every section, should make application for the complete bulletin,* as it will contain discussions of important subjects and will include the plans and practices of no less than 150 farmers throughout the State who have made a success with home-mixing of fertilizers and composts.

The need of home-mixing of fertilizers and composts.—Every farmer should carefully study the needs of his soils, and find out the requirements of each field, systematically and rationally. Fertilizing applications should be carefully added to prevent waste of food materials and the consequent deterioration of the land. To do this, all home materials that may be of value in fertilizing applications should be preserved and utilized in home-made composts or mixtures. Stable manure should be carefully handled and preserved according to plans referred to in the complete bulletin mentioned above. The plan is recommended of adding one part of kainit to two parts of acid phosphate to the manure as it is made, and one pound and a half of this per animal per day is advised to be sprinkled upon the manure and litter as it is collected each day. Cotton seed should be saved and either returned to the soil or else exchanged for cotton-seed meal. This can be fed or else applied as a fertilizer for the coming crop. Straw and leaves from the forest can be used for bedding or litter in stables. Muck can also be saved and composted with stable manure. Ashes can be saved and utilized. It will be found, however, that it will be necessary to buy some fertilizing materials, and these principally are acid phosphate and some potash ingredients, such as kainit or muriate of potash. These should be combined with the materials saved at home, in the proportions stated in the formulas on the following pages.

How to proceed in home-mixing of fertilizers.—Fertilizing materials may be bought and used independently of the materials saved on the farm. They can be mixed in proportions to form a regular fertilizer just as is done by the manufacturer, or they can be combined with stable manure or other material to form a compost. Many proportions suitable to various crops are given hereafter. The advantages of home mixing of fertilizing ingredients are that the proportions can be altered to suit individual soils and crops, and also that special ingredients can be used for these purposes It is not a difficult matter to mix these ingredients. It can be done on any rainy day and at an expense of about 50 cents per ton. The ingredients should be as fine and dry as possible, and if there are any lumps they should be mashed. A clean floor or hard ground can be used, and under shelter. The materials are weighed out in the proportion to form a fourth to half ton. They are then poured out in layers on top of each other and mixed with hoes from each side of the pile. A wagon body may be used for mixing a small quantity. When the mixture shows uniform color throughout, the mixing can be stopped. Smaller weights of ingredients especially should be most thoroughly mixed with the other ingredients in the pile. It is not absolutely necessary to weigh each ingredient, if scales be not convenient, as the bags containing them can be subdivided with sufficient accuracy for general purposes. Mixing can be done immediately before applying, if desired, and can be kept after mixing as long as convenient, except those containing nitrate of soda, which should be used soon after being mixed.

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* When making application, specify *Bulletin No. 139 Complete.*

The advantages of compost-making.—The special advantages of compost-making are also that the proportions may be altered and special ingredients used, if desired. Another important consideration is that a large quantity of organic matter is thus applied to the soil, in which in many crops, such as clean corn and cotton culture, it is specially deficient. A particular benefit also in such a case is that the organic matter lightens up the soil and improves its mechanical condition, in addition to introducing the fertilizing ingredients contained in it. Another advantage is that it will act as a mulch in the soil and prevent the escape of moisture and thus prevent, in some degree, the bad results of long continued drought.

When to prepare composts.—This depends largely upon the materials used. If cotton seed be one of the ingredients, or leaf mold or other materials that should be fermented in order to change them into better character of plant food, then the material should remain in compost heap for four or five weeks or a sufficient time to kill the seed and prevent germination. The cotton seed hulls, too, by this change are made more available. If such materials are already in a well rotted and fermented condition it is not necessary that the fertilizing ingredients should be mixed with them at all. In such a case the fertilizing ingredients may be applied in the furrow with the stable manure, using the proportions given in the formulas to follow.

How and where to prepare the compost.—Where the materials require fermentation, or the manure is not well rotted, the compost heap should be made. It should be prepared at a convenient place to the stable manure, and need not necessarily be under shelter.* A hard, compact soil is advised for this purpose. If cotton seed is one ingredient, a layer of stable manure is first put down, then a layer of cotton seed; upon this the acid phosphate, next cotton seed, then stable manure, then acid phosphate, then kainit, and repeat in the order named. The size of the layers and thickness will depend upon the quantity of compost desired to be made. Thirty pounds of cotton seed is the legal weight per bushel, and the same weight is used for stable manure. These materials can therefore be measured instead of weighed. Each layer should be wetted when put down, and the heap built up in conical shape and covered with rich earth to prevent the entrance of air, which will injuriously affect the fermentation. The heap may be examined from time to time, and if there is evidence of being too hot, water can be poured in to moisten it. At the time the compost is to be used, it should be chopped from top to bottom and thoroughly mixed. Other mixtures for composts can be made in the same way. Lime should not be mixed with stable manure, as it decomposes it. A limited quantity of ashes may be used, if they do not come in immediate contact wih the manure Rich earth should then be used to cover the heap.

Many farmers prefer to prepare numerous small heaps in different parts of the field, and use earth from the ditch banks in the preparation, considering that it is too much labor to haul this dirt to the barn-yard to add to the compost, and then haul it back. While this is true, still most of the dirt from ditch banks is hardly the best material to use for the purpose, and if it is not sufficiently rich, it should not be used at all. If it is sufficiently rich, and with much organic matter, and with little sand or loam, one can afford to haul the best of it to the barn-yard, where the larger compost heap is being made. In this way the heap can be better mixed and far better cared for, and the result will be much superior to the smaller heaps in the field, because the organic matter can be better decomposed by the stable manure.

How much to apply.--This will depend entirely upon the means and the intentions of the owner. It is a bad policy to applv too little. If the plants be not fed, they cannot give good yields. We would advise every farmer to measure first the amount of money that can be afforded for fertilizing applications. Select next the formulas with materials that may be thought better for the purpose and can be most conveniently secured. Then decide on the amount of application, on the basis of the cost rather than the actual weight. For ordinary staple crops upon average soils, the cost of fertilizers should be at least two to three dollars per acre. A larger quantity will give proportionately better returns. For most purposes, then, it should not be forgotten that the larger the application the greater will be the crop yield.

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* A convenient plan is to have a square rail pen made with 8-foot rails laid horizontally. Boards can be put inside to the height of a foot or two from the bottom. Composts can be made in this pen which can easily be covered. Stable manure can also be saved in such a pen.

How and when to apply.—If the application of compost is very large, it is advisable to apply half broadcast and the other half in the opening furrow, and bed on it, so as to mix it thoroughly with the soil. With a more moderate application it all should be applied in the furrow. In planting the seed, a good practice is that recommended by the Georgia Station—to add with the seed a small quantity of readily available fertilizer, so as to give plant food for the immediate needs of the young plants. For this purpose, 30 pounds of acid phosphate, 10 pounds nitrate of soda, and 60 pounds rich, dry dirt, are mixed carefully together and applied to each acre with the seed when sown, or with the plant when set. If these cannot conveniently be had, 50 to 75 pounds of an ammoniated fertilizer per acre may be used. In no case is it advised to put fertilizers immediately in contact or too near the seed or plant. In many cases, too close application injures the small plants, and a bad stand is the result. It must be remembered that the young rootlets, being very tender, will be destroyed, and the plants thus be killed, if they come in contact with the fertilizers. The use of grain drills for sowing fertilizers and grain together, often injuriously affects the stand of the grain. This is particularly the case with mixtures containing cotton-seed meal. This can be prevented by drilling the fertilizer previous to the seed, and across the direction of the latter.

Top-dressings.—A top-dressing for small grains and clover is of much value, particularly where the fertilizing application has not been thoroughly made at the time of planting. It is readily soluble and available to the plant. Several formulas for top-dressing are given on the pages following. Nitrate of soda is often used for this purpose, for cotton or corn, at the rate of 50 to 75 pounds per acre. It should be mixed with rich, dry earth and applied as a top-dressing when the plants are from six to eight inches high.

Do not apply fertilizers or composts too near the seed or plant.—Special attention should be given to this point. Besides being a danger to the small plants, as already mentioned, if the applications are too near, the roots will soon pass out of reach, and additional food will not be available. It should be remembered that roots of staple crops often measure as much as six to eight and even ten feet in length. Even the shorter roots spread beyond six or eight inches. The fertilizers and compost, consequently, should be applied so that they can readily be utilized by the longer as well as the shorter roots.

The use of stable manure.—Many farmers prefer to haul stable manure directly to the field as soon as made. This, doubtless, is a good plan for grass lands, and possibly small grains, but for cultivated crops all the manure should best be applied at the same time, and much loss by leaching and washing rains is thus prevented. Another advantage is, that by saving the manure in the heap, the litter can be put in much better condition by the fermentation of the manure. In fact, this fermentation really improves the quality of the manure itself. To allow such fermentation to take place on top of the soil where the manure has been broadcasted, will inevitably result in loss of valuable nitrogen, and unless a crop is then growing on the land, much surface washing and leaching in hilly countries will be the result.

Stable manure composted with other ingredients, to be used in addition to those given in the formulas.—In many cases a larger quantity of stable manure may be available for use than is given in the proportions mentioned in the formulas below. Probably large quantities of muck, or rich earth from ditch-banks, etc., may also be procured. If such be the case, it is always advisable to use as much of these materials as is possible, in addition to the regular application given in the proportions in the following formulas. Stable manure is mixed with the muck, etc., in the proportion of one part of the former to four or five of the latter. Put down in layers, and moisten each layer. This should be mixed at least six weeks before using, and should be broadcasted and plowed or cultivated in. There is hardly any limit to the quantity of this mixture that can be profitably used per acre. If stable manure is not to be had, the muck, etc., can be made more available by the action of salt-slaked lime. The proportions to be used are as follows:

20 parts of muck, leaves, etc.
1 part of salt-slaked lime.

The salt-slaked lime can be made by taking 6 bushels of fresh building-lime, and slake with 1 bushel of salt dissolved in water. Chemical action soon disintegrates the muck. Marl or agricultural lime, and kainit, four of the former to one of the latter, are good substitutes for the salt-slaked lime. Wet each layer of the heap as put down. The lime should not be mixed with stable manure.

Cost of ingredients.—Below will be found an approximation of the cost of ingredients at the average interior point, say in the central portion of the State. These quotations cannot be exact for all localities. They are inserted here to give the probable cost to secure them. The quotation on acid phosphate is based on 13 per cent, and this grade is used invariably in the mixtures. It is not good policy to purchase a lower grade article, and it is really dearer to buy such material than a higher grade. No price is placed on the stable manure or the other home materials that should be saved without cost to the farmer.

APPROXIMATE RETAIL COST OF FERTILIZING INGREDIENTS IN CENTRAL NORTH CAROLINA.

Acid phosphate, 13 per cent	$14	per ton of	2,000 lbs.
Kainit, 12 per cent actual potash	14	"	"
Cotton-seed meal	20	"	"
Nitrate soda, 19 per cent ammonia	47	"	"
Cotton seed	10	"	"

Muriate potash, 50 per cent actual potash	$46	per ton of 2,000 lbs.
Fish scrap, 10 per cent ammonia	27	" "
Sulphate of potash, 48 per cent actual potash	50	" "
Tobacco stems	5	" "

Formulas for home-mixed fertilizers and composts.—The formulas given in the following pages are intended as suggestions only. It is expected that the thoughtful farmer will vary the proportions, if he has found by experience that his soil requires it. In presenting these formulas, the endeavor has been to use materials of ordinary occurrence, or those that could be secured with the least difficulty. The proportions all approximate those that have been by actual practice found to give the best results. The quantities to be applied per acre should be governed by the cost as already explained.

FORMULAS FOR MIXTURES AND COMPOSTS.

[If the compost materials are well rotted, it is not necessary to mix the fertilizers with them, but apply independently.]

[The proportions named should be the basis of application: and as much stable-manure-and-muck-compost or lime-treated-compost should be applied in addition as is possible.]

[The quantities to be applied per acre should be governed entirely by the cost, which should not be less than $2 to $3 per acre.]

[It is bad policy to apply too little, and the intensive system will always pay.]

[Acid phosphate should contain at least 13 per cent available phosphoric acid].

Formulas for Cotton and Corn.

No. 1. Mixed Fertilizer.—Cost per ton (2,000 lbs.) $14.65. A useful formula. For cotton on clay or gravelly soils, the kainit may be reduced by 100 to 200 pounds, increasing the acid phosphate accordingly. The kainit may, in some instances, be reduced to 200 pounds (increasing the acid phosphate) if there is no danger of rust in cotton. A farmer who has used this last proportion, writes: "This formula that you gave me several years ago costs me generally from $15 to $16. I find it cheaper and better than fertilizers manipulated that cost me here about $21 to $22."

Acid phosphate	1,000 pounds.
Cotton-seed meal	600 pounds.
Kainit	400 pounds.
Total	2,000 pounds.

No. 2. Mixed Fertilizer.—Cost per ton, $20.15. A higher grade article than No. 1.

Acid phosphate	1,200 pounds.
Fish scrap	700 pounds.
Muriate potash	100 pounds.
Total	2,000 pounds.

No. 3. Mixed Fertilizer.—Cost per ton, $20.95. Also a high grade article.

Acid phosphate	1,000 pounds.
Cotton-seed meal	700 pounds.
Nitrate soda	100 pounds.
Muriate potash	200 pounds.
Total	2,000 pounds.

No. 4. Mixed Fertilizer.—Cost per ton, $14.65. A useful formula where these materials can be easily procured. The portions should be well mixed.

Acid phosphate	1,000 pounds.
Muriate potash	100 pounds.
Nitrate soda	100 pounds.
Cotton-seed meal	300 pounds.
Woods mold or rich earth	500 pounds.
Total	2,000 pounds.

No. 5. Mixed Fertilizer.—Cost per ton, $7.70. Tobacco stems may be easily procured in some localities. They should be as finely ground as possible.

Acid phosphate	600 pounds.
Tobacco stems	1,400 pounds.
Total	2,000 pounds.

No. 6. Compost.—Cost per ton, $7.25. A very serviceable compost, and one that will give general satisfaction. Cotton seed weighs 30 lbs. per bushel. Stable manure is allowed the same weight.

Stable manure	750 pounds.
Kainit	100 pounds.
Acid phosphate	400 pounds.
Cotton seed	750 pounds.
Total	2,000 pounds.

No. 7. Compost.—Cost per ton, $8.05. If manure is well rotted, the fertilizing ingredients can be applied separately, and not mixed with it. Be careful to have the ingredients well incorporated together.

Acid phosphate	650 pounds.
Muriate potash	50 pounds.
Nitrate soda	100 pounds.
Stable manure	1,200 pounds.
Total	2,000 pounds.

No. 8. Compost.—Cost per ton, $6.50. In this and other composts, if the manure is well rotted, the fertilizers can be applied separately. Muck can be used as a portion of manure.

Kainit	100 pounds.
Acid phosphate	400 pounds.
Stable manure	1,200 pounds.
Cotton-seed meal	300 pounds.
Total	2,000 pounds.

No. 9. Compost.—Cost per ton, $3.97. A low-priced but very efficient mixture. The bulk is of advantage, as it introduces much humus to the corn or cotton land. No. 19 can also be used in the same way.

Kainit	100 pounds.
Acid phosphate	300 pounds.
Nitrate soda	50 pounds.
Stable manure and woods mold	1,550 pounds.
Total	2,000 pounds.

No. 10. Compost.—Cost per ton, $5.15. Ashes should always be saved, protected from the weather. In making the compost, do not allow the ashes to touch the manure.

Acid phosphate	400 pounds.
Ashes (hardwood unleached)	300 pounds.
Nitrate soda	100 pounds.
Stable manure	800 pounds.
Rich earth or muck	400 pounds.
Total	2,000 pounds.

Formulas for Small Grain.

No. 11. Mixed Fertilizer.—Cost per ton, $17.90. Can be planted with the seed in the grain drill.

Acid phosphate	1,000 pounds.
Kainit	400 pounds.
Fish scrap	600 pounds.
Total	2,000 pounds.

No. 12. Mixed Fertilizer.—Cost per ton, $15.80. Cotton-seed meal sometimes injures the stand, if planted with the grain. The grain drill can be used if the fertilizer is planted first and across the planting drills.

Acid phosphate	1,000 pounds.
Cotton-seed meal	600 pounds.
Kainit	400 pounds.
Total	2,000 pounds.

No. 13. Mixed Fertilizer.—Cost per ton, $16.25. A mixture to utilize tobacco stems.

Commercial ammoniated fertilizer	1,500 pounds.
Tobacco stems	500 pounds.
Total	2,000 pounds.

No. 14. Mixed Fertilizer.—Cost per ton, $9.50. This utilizes the tobacco stems. Tobacco stalks, if chopped fine, could be used. Should preferably be used after peas or clover.

Acid phosphate	1,000 pounds.
Tobacco stems	1,000 pounds.
Total	2,000 pounds.

No. 15. Compost.—Cost per ton, $8.60. A very useful formula where cotton seed is available.

Acid phosphate	600 pounds.
Kainit	200 pounds.
Cotton seed	600 pounds.
Stable manure	600 pounds.
Total	2,000 pounds.

No. 16. Compost.—Cost per ton, $7.20. Muck can be used in part for the manure. This formula gives its best return after peas or clover.

Acid phosphate	700 pounds.
Muriate potash	100 pounds.
Stable manure	1,200 pounds.
Total	2,000 pounds.

No. 17. Compost.—Cost per ton, $7.20. Especially useful after clover or peas.

Acid phosphate	700 pounds.
Muriate potash	100 pounds.
Rich earth	600 pounds.
Stable manure	600 pounds.
Total	2,000 pounds.

No. 18. Compost.—Cost per ton, $2.80. Also best after peas or clover, as it contains too little nitrogen (or ammonia) for the required application.

Acid phosphate	300 pounds.
Stable manure	900 pounds.
Kainit	100 pounds.
Muck	700 pounds.
Total	2,000 pounds.

No. 19. *Compost.*—Cost per ton, $13.20. A very serviceable grain compost.

Acid phosphate	700 pounds.
Cotton-seed meal	600 pounds.
Stable manure	600 pounds.
Muriate potash	100 pounds.
Total	2,000 pounds.

Formulas for Tobacco.

No 20. *Mixed Fertilizer.*—Cost per ton, $22.85. This is a high-grade tobacco fertilizer, containing nearly 8 per cent of actual potash. To many who believe that tobacco requires so large a per cent of potash, this formula will be very useful. It will give universal satisfaction in eastern North Carolina. Applications should not be made too near the plants, as the cotton-seed meal, under certain conditions of weather, might have some injurious effect. The potash is in the best form for bright tobacco.

Acid phosphate	1,000 pounds.
Sulphate potash	300 pounds.
Cotton-seed meal	600 pounds.
Nitrate soda	100 pounds.
Total	2,000 pounds.

No. 21. *Mixed Fertilizer.*—Cost per ton, $15.80. While we do not recommend kainit as a source of potash for yellow tobacco, because it does not cure bright nor keep its color, still some may not have other materials at hand. Under such condition, this mixture will answer well. It can be used for the darker types. It should not be applied too close to the plants.

Acid phosphate	900 pounds.
Cotton-seed meal	600 pounds.
Kainit	500 pounds.
Total	2,000 pounds.

No. 22. *Mixed Fertilizer.*—Cost per ton, $21.05. This mixture will be found a valuable application, with 5½ per cent of potash. Very closely resembles No. 20 in other respects. A prominent tobacco grower writes in regard to this formula: "The crop made a fine growth, ripening nicely throughout the plant, producing a fine, smooth leaf and of good body and weight. While tobacco was diseased more than usual in this section with 'frog-eye,' I had but little in my crop. It was generally conceded that I produced the finest crop of tobacco in the neighborhood."

Acid phosphate	1,100 pounds.
Cotton-seed meal	600 pounds.
Nitrate of soda	100 pounds.
Sulphate of potash	200 pounds.
Total	2,000 pounds.

No. 23. *Mixed Fertilizer.*—Cost per ton, $12.50. This can be conveniently used where tobacco stems are available. The finer they are, the better.

Commercial ammoniated fertilizer	1,000 pounds.
Tobacco stems	1,000 pounds.
Total	2,000 pounds.

No. 24. *Mixed Fertilizer.*—Cost per ton, $9.20. A very serviceable mixture with tobacco stems. It will be found very effective. Its cheapness will enable the tobacco-grower to use a larger quantity than the more concentrated mixtures.

Acid phosphate	600 pounds.
Cotton-seed meal	200 pounds.
Tobacco stems	1,200 pounds.
Total	2,000 pounds.

No. 25. Mixed Fertilizer.—Cost per ton, $17.90. As kainit is here used, the formula will give better satisfaction on the heavy, dark tobaccos. It may also be used by those who have not found this form of potash unobjectionable.

Acid phosphate	800 pounds.
Kainit	600 pounds.
Fish scrap	600 pounds.
Total	2,000 pounds.

No 26. Compost.—Cost per ton, $9.70. On some cotton farms, tobacco is also used. The cotton seed can be prepared in a compost according to the proportions below. It will be found very serviceable.

Acid phosphate	600 pounds.
Sulphate of potash	100 pounds.
Cotton seed	600 pounds.
Stable manure	700 pounds.
Total	2,000 pounds.

No. 27. Compost.—Cost per ton, $8.65. The proportions of this compost omit cotton seed and use nitrate soda, a quick-acting ingredient.

Acid phosphate	600 pounds.
Nitrate of soda	100 pounds.
Kainit	300 pounds.
Stable manure	1,000 pounds.
Total	2.000 pounds.

No. 28. Compost.—Cost per ton, $9.05. This will be found a very desirable compost, and one that will give satisfaction. Its cheapness also enables one to use a much larger quantity. In this formula, as well as the others, if the stable manure is well rotted, it is not necessary to mix the other ingredients with it.

Acid phosphate	600 pounds.
Nitrate soda	100 pounds.
Sulphate of potash	100 pounds.
Stable manure	1,200 pounds.
Total	2,000 pounds.

No. 29. Compost.—Cost per ton. $10.75. Where fish scrap is available, this will prove a very acceptable formula. Its grade is somewhat better than No. 28.

Stable manure	1,000 pounds.
Acid phosphate	600 pounds.
Sulphate of potash	100 pounds.
Fish scrap	300 pounds.
Total	2,000 pounds.

Formulas for Grass.

No. 30. Mixed Fertilizer.—Cost per ton, $19.10. A useful formula for lawns, but can be used also for grass lands, particularly as a top-dressing.

Acid phosphate	600 pounds.
Cotton-seed meal	600 pounds.
Kainit	600 pounds.
Nitrate of soda	200 pounds.
Total	2,000 pounds

No. 31. Mixed Fertilizer.—Cost per ton, $16.70. The materials more commonly at hand are here used. It can be used for grass lands or lawns, as a regular application or a top dressing.

Acid phosphate	500 pounds.
Cotton-seed meal	900 pounds.
Kainit	600 pounds.
Total	2,000 pounds.

Formulas for Vegetables.

No. 32. Mixed Fertilizer —Cost per ton, $16.40. This is a good all-round mixture for garden vegetables. The materials, however, are not such to force an early crop, so desirable for trucking purposes. No. 38 is better for that purpose.

Acid phosphate	500 pounds.
Cotton-seed meal	800 pounds.
Kainit	700 pounds.
Total	2,000 pounds.

No. 33. Mixed Fertilizer.—Cost per ton, $18.20 The ordinary ammoniated fertilizer can be improved for vegetables by increasing the percentage of ammonia and potash, as in the following mixture. This will give far better results for vegetables:

Commercial ammoniated fertilizer	1,000 pounds.
Cotton-seed meal	400 pounds.
Kainit	600 pounds.
Total	2,000 pounds.

No. 34. Mixed Fertilizer.—Cost per ton, $6.80. Where tobacco stems are available, they can be mixed in the proportion below with acid phosphate.

Acid phosphate	400 pounds
Tobacco stems	1,600 pounds.
Total	2,000 pounds.

No. 35. Mixed Fertilizer.—Cost per ton, $12 50. A formula to utilize tobacco stems for vegetables They must be mixed with other ingredients to give their best effect.

Commercial ammoniated fertilizer	1,000 pounds.
Tobacco stems	1,000 pounds.
Total	2,000 pounds.

No. 36. Mixed Fertilizer.—Cost per ton, $21.00. This formula is especially for beans and peas, as they require a smaller percentage of ammonia. It is intended for trucking purposes or those requiring early maturity.

Acid phosphate	1,200 pounds.
Cotton-seed meal	450 pounds.
Nitrate soda	100 pounds.
Muriate potash	250 pounds.
Total	2,000 pounds.

No. 37. Mixed Fertilizer.—Cost per ton, $27.65 —Especially for Irish potatoes, although it can be used for most trucking crops, except peas and beans and cabbage, when Nos. 36 and 39 give better results For early crops. A correspondent who used this formula, excepting tankage in place of fish scrap, reports a yield of 150 bushels of Irish potatoes per acre with ½ ton of the mixture. Stable manure is objectionable for Irish potatoes as it promotes "scab." Chemical fertilizers are therefore better.

Acid phosphate	800 pounds.
Fish scrap	600 pounds.
Nitrate soda	300 pounds.
Muriate potash	300 pounds.
Total	2,000 pounds

No. 38. Mixed Fertilizer.—Cost per ton, $25.55. A very popular and tried mixture, especially for Irish potatoes and other vegetables, as mentioned under No. 37. It will give satisfaction. It is for early crops and for trucking purposes. A grower writes, regarding this mixture. "The result of your formula you furnished me about two years ago is as follows: I tested it along with other fertilizers, costing me $42.50 cash, and got as good if not a better crop of Irish potatoes from your formula, which only cost me $26. I got one of our best farmers here to try a ton of your formula alongside of a fertilizer which cost him $42.50 cash, or $45 on time, and he says he could not see any difference in the

crop of Irish potatoes, only he saved $16.50 in the cost of the two fertilizers, which he considered a big item to farmers. I use it exclusively."

Acid phosphate	800 pounds.
Cotton-seed meal	600 pounds.
Nitrate soda	300 pounds.
Muriate potash	300 pounds.
Total	2,000 pounds.

No. 39. Mixed Fertilizer —Cost per ton, $25.85. The proportions are especially suitable for cabbage and other leafy vegetables. The mixture is intended for early forcing for trucking crops.

Acid phosphate	700 pounds.
Cotton-seed meal	700 pounds.
Muriate potash	300 pounds.
Nitrate soda	300 pounds.
Total	2,000 pounds.

Formulas for Sweet Potatoes.

No. 40. Mixed Fertilizer.—Cost per ton, $20.90. A high grade mixture, containing 8 per cent of potash. Sweet potatoes do not require a large amount of ammonia.

Acid phosphate	1,000 pounds.
Muriate potash	300 pounds.
Cotton-seed meal	700 pounds.
Total	2,000 pounds.

No. 41. Mixed Fertilizer.—Cost per ton, $18.80. This utilizes cotton-seed hull ashes, a valuable material where it can be procured. The grade of the mixture is not so high as No. 40.

Acid phosphate	900 pounds.
Cotton-seed meal	600 pounds.
Cotton-seed hull ashes	500 pounds.
Total	2,000 pounds.

No. 42. Mixed Fertilizer.—Cost per ton, $15.50. The materials here used can easily be procured. This mixture will be found very useful for home gardening or for field use.

Acid phosphate	700 pounds.
Kainit	800 pounds.
Cotton-seed meal	500 pounds.
Total	2,000 pounds.

No. 43. Mixed Fertilizer.—Cost per ton, $18.20. Where it is desired that a commercial fertilizer be used, it should be mixed with kainit or some potash salt, and cotton seed meal. The below is a convenient formula. Sweet potatoes require a higher per centage of potash than is contained in the usual staple fertilizer.

Commercial ammoniated fertilizer	1,200 pounds.
Kainit	600 pounds.
Cotton-seed meal	200 pounds.
Total	2,000 pounds.

Formulas for Peanuts.

No. 44. Mixed Fertilizer.—Cost per ton, $16.60. A convenient and useful formula where fish scrap can be procured. Peanuts require lime in addition, if soil does not contain it. From 300 to 600 lbs. slaked lime (agricultural lime) should be used per acre in the furrow. This will prevent "pops."

Acid phosphate	900 pounds.
Kainit	700 pounds.
Fish scrap	400 pounds.
Total	2,000 pounds.

No. 45. Mixed Fertilizer.—Cost per ton, $15.20. This formula will be found very serviceable and convenient to procure. Use lime in addition, as in No. 40.

Acid phosphate	1,000 pounds.
Kainit	600 pounds.
Cotton-seed meal	400 pounds.
Total	2,000 pounds.

No. 46. Mixed Fertilizer.—Cost per ton, $19.80. A high grade mixture with larger percentage than the foregoing. It is best to use lime in addition, as mentioned under No. 40.

Acid phosphate	1,400 pounds.
Muriate potash	200 pounds.
Fish scrap	400 pounds.
Total	2,000 pounds.

Formulas for Fruit.

No. 47. Mixed Fertilizer.—Cost per ton, $16.40. Where other materials cannot be had, the following will make a good mixture for tree fruits growing, and for small fruits.

Acid phosphate	500 pounds.
Kainit	700 pounds.
Cotton-seed meal	800 pounds.
Total	2,000 pounds.

No. 48. Mixed Fertilizer.—Cost per ton, $24.20 This is a better formula than the preceding, and of higher grade. It is for small fruits, and especially for forcing for an early market. It is also useful for tree fruits when growing. It contains 8 per cent. potash. For a higher percentage, see No. 49. For tree fruits, the application should be graduated according to the age of the trees. Applications should be made evenly over a circle as far as the branches extend.

Acid phosphate	800 pounds.
Cotton-seed meal	700 pounds.
Nitrate soda	200 pounds.
Muriate potash	300 pounds.
Total	2,000 pounds.

No. 49. Mixed Fertilizer.—Cost per ton, $25.20. For a quick acting fertilizer for early small fruits this mixture will be very useful. It contains 10 per cent. of potash. Some prefer to use sulphate potash in place of muriate. The former is claimed to give a sweeter berry and a higher color. The mixture can also be used for orchard fruits. The applications should be graduated according to the age of the tree. Apply evenly in a circle as far as the branches extend.

Acid phosphate	900 pounds.
Cotton-seed meal	500 pounds.
Nitrate soda	200 pounds.
Muriate potash	400 pounds.
Total	2,000 pounds.

No. 50. Mixed Fertilizer.—Cost per ton, $21.90. A mixture like this, high in potash (10 per cent.) and phosphoric acid, and low in nitrogen (ammonia), is specially to be commended for orchard fruits in bearing.

Acid phosphate	1,100 pounds.
Cotton-seed meal	500 pounds.
Muriate potash	400 pounds.
Total	2,000 pounds.

Formulas for Cowpeas.

No. 51. Mixed Fertilizer.—Cost per ton, $15.20. Ordinarily cowpeas will not need nitrogen (or ammonia), but in poorer soils some is serviceable to start the growth, after which it begins to take advantage of the atmospheric nitrogen.

Acid phosphate	1,000 pounds.
Kainit	600 pounds.
Cotton-seed meal	400 pounds.
Total	2,000 pounds.

No. 52. Mixed Fertilizer.—Cost per ton, $14.00. On the better class of soils, especially if peas have previously been grown, the nitrogen application can be dispensed with. The equivalent in muriate potash to kainit may be used. Muriate is four times as strong as kainit.

Acid phosphate	1,300 pounds.
Kainit	700 pounds.
Total	2,000 pounds.

Formulas for Top-Dressings.

No. 53. Mixture.—Cost per ton, $6.80. A dressing of lime is oftentimes of value on clover grasses or small grain. When combined with kainit, the chlorides of the latter form a chemical combination with the lime, which reacts with beneficial results on the soil and the growing crops. The lime is valued at $5.00 per ton. The potash also is of benefit.

Air-slaked lime (agricultural lime)	1,600 pounds.
Kainit	400 pounds.
Total	2,000 pounds.

No. 54. Nitrate Soda.—Cost per 50 lbs., $1.17. This quantity is for one acre. Can be used for cotton or corn, or small grains or grasses. A very soluble and useful material. It should be well mixed with dry earth to facilitate an even application. The quantity in some cases might be increased to 75 pounds.

Nitrate soda	50 pounds.

No. 55. Mixture.—Cost per 150 lbs., $1.05. This quantity is for one acre. A good application for clover, or mixed grasses containing clover, or even grass or small grains. The land plaster (gypsum) contained in the acid phosphate is of much service as an indirect fertilizer. The phosphoric acid and potash add to this value as a direct fertilizer. The quantity per acre may be increased in proportion.

Acid phosphate	100 pounds.
Kainit	50 pounds.
Total	150 pounds.

No. 56. Mixture.—Cost per 200 lbs., $1.70. This quantity is for one acre. It is a convenient one for grass and small grain.

Acid phosphate	50 pounds.
Cotton-seed meal	100 pounds.
Kainit	50 pounds.
Total	200 pounds.

No. 57. Mixture.—Cost per ton, $19.10. This is the same as No. 31. It is very useful for grasses. See also No 30.

Acid phosphate	500 pounds.
Cotton-seed meal	900 pounds.
Kainit	600 pounds.
Total	2,000 pounds.

Volumetric Estimation of Phosphoric Acid

A FURTHER COMMUNICATION ON THE ESTIMATION OF PHOSPHORIC ACID BY TITRATION OF THE AMMONIUM PHOSPHO-MOLYBDATE PRECIPITATE WITH STANDARD ALKALI.

ISSUED BY THE
NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION
RALEIGH, N. C.

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AGRICULTURAL EXPERIMENT STATION

AND

THE FERTILIZER CONTROL STATION

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Volumetric Estimation of Phosphoric Acid.

A Further Communication on the Estimation of Phosphoric Acid by Titration of the Ammonium Phospho-molybdate Precipitate with Standard Alkali.

By B. W. Kilgore.

During the past four years the writer has done a large amount of work on this method,[1] and the results obtained in this laboratory for the past two years, at least by five analysts, warrant us in considering it thoroughly accurate and reliable. More recently the method has been extensively and successfully employed in experiment station and other laboratories. Some chemists, however, have not been able to secure uniformly good results with it. These appear to be mostly those who have worked the method but little, while the difficulty with others seems to be due to a misunderstanding as to how the method should be carried out.

At the last meeting of the Association of Official Agricultural Chemists, two main objections were brought against its adoption as an official method at that time. One was that it had not been tried upon a sufficient variety of fertilizers and fertilizer materials used in the trade to show that it would give as good results with all others as it had upon the materials already employed. The other objection was the one brought forward in the paper[2] of Mr. T. S. Gladding. Mr. Gladding had made 22 comparative tests of the volumetric method with the official gravimetric and his gravimetric methods on a microcosmic salt and various fertilizers, with closely agreeing results in all cases. He then turned over a set of precipitates to an assistant to filter and wash free from acid according to the method. It was found that the precipitates could not be freed from acid, and upon closer examination it was observed that the water was dissolving the precipitate.

The experiments, the results of which follow in the table herewith, were planned to throw light upon and if possible to settle these two questions.

With reference to the variety of materials, an examination of the publications referred to under reference (1) below will show that the method has already been worked upon quite a variety of fertilizer materials and mixed goods, which, with the materials investigated in this paper, appears to include nearly all, if not all, the sources of phosphoric acid in the fertilizer trade. Besides these, the large number of results presented to the Association last year by Mr. John P. Street, and published in the Annual Report of the New Jersey Station,[3] shows that the method gives good results on mixed goods. Mr. Street says: "The materials analyzed included 276 complete fertilizers, of varying composition and origin, and are believed to fairly represent the average goods on the market at the present time. The results secured were extremely satisfactory, the average results by the volumetric method being 10.72 per cent. against 10.70 per cent. by the official method. Of these results, 150 were higher by the volumetric, 113 lower, and 13 identical with the official method; the greatest variation was 0.16 per cent., and 114 samples varied less than 0.05 per cent."

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[1] See proceedings of Association of Off. Agricultural Chemists, Bulletins 43, pp. 68–104; and 47, pp. 62–83, U. S. Dept. Agriculture; Bul. 119 of this Station; and Jour. Am. Chem. Soc., Vol. 16, No 11, and Vol. 17, No. 12.

[2] Bulletin 49, Chem. Div. U. S. Dept. Agr., p. 75.

The results obtained by both the gravimetric and volumetric methods on the samples reported in this paper show good agreement, except those on samples 6 and 7, (American and European manufactured Thomas slags). The American slag contained a very large amount of iron and the European one quite a considerable quantity, though not so large. When the yellow precipitates from these samples were dissolved on the filter with dilute ammonia water considerable iron remained on the filter. The results marked "a" in the table were secured by carrying these through according to the usual custom without reprecipitating to get rid of iron. These "a" results are about 0.40 per cent. higher than the corresponding volumetric ones on the American slag, and considerably higher on the European one. The "white" precipitates giving these high results were seen by color and shown by chemical test to contain iron. A second set of determinations on these samples was then made, using the same solutions from which the above results were obtained and precipitating twice with molybdic solution to get rid of iron, when results *c c* and *b* were secured. These results show close agreement with the volumetric ones. Result "*b*" still contained a small amount of iron.

It appears, then, that the volumetric method has not only given as good results on all the samples here worked, including the *very high* percentages as the gravimetric method, but on the samples containing large amounts of iron the results have been better. I might state in this connection that we have found the volumetric method to give very satisfactory results in the determination of phosphoric acid in soils, where a large amount of iron is present.[4]

Now, as to Mr. Gladding's point of telling when the precipitate has been washed sufficiently. It might be stated here also that others have had difficulty at this point, and the statement in the method as published in Bulletin 46, Chemical Division U. S. Department of Agriculture, page 14, to wash the precipitate "till no longer acid," is responsible to some extent at least for this trouble.

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[3] Seventeenth Annual Report. p. 118.

[4] Bulletin 47, Chem. Div. U. S. Dept. Agr., p. 82.

It is well known that ammonium phosphomolybdate is slightly soluble in water, and is an acid salt, and it would therefore be impossible to get a filtrate from washing with water that would be strictly neutral to very delicate indicators like phenolphthalein. It will be found, however, that when the filtrate is allowed to drop from the neck of the funnel upon delicate litmus paper that the wash water will be neutral to litmus after 100 to 200 c. c. water has passed through. The work here reported, and that previously done by us,[5] together with the work of Street,[6] McDonnell, and others, shows that 150 to 250 c. c. water, and often less, has been sufficient in all cases to free the precipitates from acid. But as stated by the writer in a previous paper on washing the yellow precipitate, "There is danger, however, of mechanical loss. The precipitate is first washed by decantation with dilute nitric acid and potassium nitrate, and afterwards with water to remove the nitric acid. It is in this after-washing, when all the salts have been removed from the precipitate and as much as 600 to 700 c. c. of water has been used, the precipitate begins to pass through the filter mechanically and settle to the bottom of the receptacle. We have not, however, found it necessary to wash with more than 300 c. c. of water."[7] Perhaps this will explain the difficulty which occurred in Mr. Gladding's laboratory, in that more water was used for washing than was necessary. When these large quantities of water are used, the precipitate not only passes through the filter and settles out in the filtrate, but it dissolves far more readily then than when smaller amounts of water are used for washing.

In the light of the experience of the past three years, however, it does not now seem to be necessary to wash with more than 150 to 200 c. c. of water, and the smaller of these is not much more, if any, than is used in washing the yellow salt in the gravimetric method.

In the results which follow in the table, I have made an additional test of the washing question by using 200 c. c. and 500 c. c. of water and the wash solutions, and making the determinations side by side and from the same solutions. The gravimetric results used for comparison were obtained on the same solutions as the volumetric ones. The results show that 200 c. c. of water, even with these *very high percentages*, was sufficient in all cases, and that 500 c. c. of water only lowered the results slightly, when at all. When 200 c. c. of 3 per cent. ammonium and potassium nitrate solutions were used for washing, the results were practically the same as those obtained when the two quantities of water were used; but when they were washed with 500 c. c., the results, greatly to my surprise, were much lower. The results were so surprising that quite a number of them were repeated, and while they were not uniform in all cases, they were always low. We had hoped to be able to wash with a very large volume of ammonium nitrate without appreciably dissolving the precipitate or causing it to run through the filter. The filtrates from these 500 c. c. ammonium and potassium nitrate washes were perfectly clear, but on evaporation the ammonium phosphomolybdate was found to be in solution.

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[5] Bul. 47, Chem. Div U. S. Dept. Agr., p. 62.

[6] Seventeenth Ann Rep. N. J. Station, p. 118.

[7] Jour. Am. Chem. Soc., Vol. 17, p. 958.

In these determinations three-inch Hirsch funnels, with discs of filter paper covering the bottoms, and strong, suction were used in filtering. The filtrates were not tested, but other determinations on the same samples, by using ordinary funnel and filter paper without pressure, showed them to be free from acid after washing with 150 to 200 c. c. of water. These results agreed well with those obtained with the pump. All the precipitates were washed twice by decantation with dilute nitric acid and once with potassium or ammonium nitrate solution before washing with water.

In view of the results with potassium and ammonium nitrate solutions, it suggested the plan of one washing by decantation with water to take the place of washing with potassium nitrate, following the washings with dilute nitric acid.

Comparative Phosphoric Acid Results on Various Fertilizer Materials by Gravimetric and Volumetric Methods.

MATERIALS.	Gravimetric Method.	Volumetric Method.	Washed with Water.	Washed with 3 per cent Potassium Nitrate.	Washed with 3 per cent Ammonium Nitrate.	Amount of Solution Corresponding to Grams Substance used in Volumetric Method.
	Per cent	*Per cent*	*c. c.*	*c. c.*	*c. c.*	*Grams.*
1. Cotton-seed Meal	2.97	------	------	------	------	------
	2.96	2 97	200	------	------	.2
	------	2.93	500	------	------	.2.
	------	2.91	500	------	------	.2
2. Tankage	11.62	------	------	------	------	------
	11.67	11.68	200	------	------	.2
	------	11.58	500	------	------	.2
	------	11.60	------	------	200	.2
	------	11.45	------	------	500	.2
3. North Carolina Phosphate	18.27	18.20	200	------	------	.2
	18.27	18.20	500	------	------	.2
	------	18.18	------	------	200	.2
	------	17.88	------	------	500	.2
4. South Carolina Phosphate	27.98	28.06	200	------	------	.2
	27.98	28.09	500	------	------	.2
	------	28.04	------	------	200	.2
	------	27.74	------	------	500	.2
5. Pennsylvania Phosphate	18.59	18 59	200	------	------	.2
	18 58	18.56	500	------	------	.2
	------	18.56	------	------	200	.2
	------	18.34	------	------	500	.2

Comparative Phosphoric Acid Results on Various Fertilizer Materials by Gravimetric and Volumetric Methods. — Concluded.

MATERIALS.	Gravimetric Method.	Volumetric Method.	Washed with Water.	Washed with 3 per cent Potassium Nitrate.	Washed with 3 per cent Ammonium Nitrate	Amount of Solution Corresponding to Grams Substance used in Volumetric Method.
	Per cent	*Per cent*	*c. c.*	*c. c.*	*c. c.*	*Grams.*
6. Thomas Slag (American)	*a* 16.38	16.05	200			2
	16.43	16.00	500			.2
	b 16.14	15.98			200	.2
	c 16.04	15.75			500	.2
7. Thomas Slag (European)	*a* 18.15	17.98	200			.2
	18 08	17 97	500			.2
	c 17.90	17.88			200	.2
		17.73			500	.2
8. Bone Meal	22.14	22 10	200			.2
	22.02	22.08	500			.2
		22.00			200	2
		21.95			500	.2
9. Acid Phosphate	17.44	17.56	200			.2
		17.51	500			.2
		17.51			200	.2
		17.30			500	.2
10. Mixed Fertilizer	10.23	10.40	200			.2
	10.25	10.35	500			.2
11. Tennessee Phosphate (Low grade)	23.08	23.11	200			.2
		23.11	500			.2
						1
12. Tennessee Phosphate (High grade)	35 07	35.00	200			.1
	34.85	35.10	500			
13. Aluminum Phosphate	46 91	47.10	200			.1
	46.82	47 20	500			.1
	47.00					
14. Florida Phosphate	37.74	37.80	200			1
	37.62	37.78	500			.1
15. Sodium Phosphate	19.97	19.96	200			.2
	20.07	19.90	500			.2
	20.03	19.76		200		.2
	19 97	18.69		500		.2
	19 82	19 90			200	.2
		19.80			500	.2

Sample No. 6, American Thomas Slag, contained a very large amount of iron. No. 7, European Slag, contained less iron.

(*a.*) Were precipitated only once with molybodic solution, and the "white" precipitates were contaminated with iron. (*b. c.*) Were precipitated twice with molybodic solution to get rid of iron The "white" precipitates giving results *c*, were free from iron, but *b* still contained some, as shown by color and chemical test.

A word may not be out of place here in regard to the titration and end reaction. The greater the amount of yellow precipitate present, the more slowly does the phenolphthalein color disappear, but up to 20 per cent., or more, when 0.2 gram of substance is used, the end reaction is quite sharp. For percentages much above twenty, I consider 0.1 gram substance better to use, when the end reaction will be found sharp for any percentages one will be called upon to work. To summarize: For percentages below five, use 0.4 gram substance (or about); for percentages between five and twenty, use 0.2 gram; and above twenty, use 0.1 gram.

It will also be found that by adding the indicator after the precipitate has been dissolved in the alkali that the molybdenum colorations which sometimes occur to interfere with the end reaction, will be avoided. This observation was made by Street in his work previously referred to, and my observations corroborate it. Of the results presented in the table, the gravimetric determinations were made by Messrs. W. M. Allen, H. K. Miller and myself, and the volumetric ones by myself.

The volumetric method was somewhat modified at the last meeting of the Association of Official Agricultural Chemists, and in such a way as to prevent the difficulty of excessive washing, mentioned in this paper. I repeat here the method in the form in which it was recommended by the Association for testing in the work of this year:

Dissolve 2 grams substance in nitric and hydrochloric acids, incinerating beforehand to destroy organic matter, if necessary, and make up to volume of 200 c. c. For percentages below 5, use 40 c. c. of solution, for percentages between 5 and 20 use 20 c. c. (and for percentages above 20 use 10 c. c.); add 5 to 10 c. c. concentrated nitric acid, nearly neutralize with ammonia, heat in water bath at 60°-65° c., add 50 c. c. freshly filtered molybodic solution for each decigram P_2O_5 present, and digest in water bath for 10 to 15 minutes.

Decant the clear liquid on the filter as quickly as possible, using Hirsch funnel with suction, or ordinary funnel and filter paper with or without pressure. Wash the precipitate by decantation twice with 10 per cent nitric acid solution, using about 50 c. c. of the solution each time, agitating thoroughly and allowing the precipitate to completely settle, once with the same amount of 3 per cent ammonium or potassium nitrate solution[1], and transfer it to the filter and wash it five or six times with water, using 150 to 250 c. c.[2] Now wash the filter and contents back into the beaker, add excess of standard alkali and then a few drops of phenolphthalein, and titrate back with standard nitric acid.

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[1] It is suggested that water be used for this washing by decantation, instead of the nitrate solution.

[2] In our experience 200 c. c. of water is sufficient.

A New Tobacco Pest

ISSUED BY
THE NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION
WEST RALEIGH, N. C.

BULLETIN No. 141

JULY 21, 1897

Publications will be sent to any address in North Carolina upon application.

NORTH CAROLINA COLLEGE OF AGRICULTURE AND MECHANIC ARTS,

WEST RALEIGH, N. C.

THE NORTH CAROLINA

AGRICULTURAL EXPERIMENT STATION

AND

THE FERTILIZER CONTROL STATION.

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Address all communications to the Director, and not to individuals. They will be referred to the members of the Station staff most competent to answer them.

N. C. COLLEGE OF AGRICULTURE AND MECHANIC ARTS.

N. C. AGRICULTURAL EXPERIMENT STATION,
WEST RALEIGH, July 21, 1897.

The tobacco crop of North Carolina is one of great importance, being the third in money value of the crops grown in the State, amounting annually to more than five millions of dollars. The increase in the State in recent years has been marked. In 1879 and 1889 North Carolina stood third in tobacco acreage in the United States and in production, sixth in 1879 and fourth in 1889. In 1896, she ranked second in the United States in acreage and second in production, and the average price per pound of the North Carolina tobacco was much greater than that grown in the other States which rivaled her in production.

It is hoped that the accompanying Bulletin may aid the tobacco planters in maintaining the quality of their product as well as increasing its yield. The present Bulletin forms a part of a comprehensive study of the fungous and insect pests of tobacco, both in the growing state and after it is manufactured. More time being required for elucidating certain parts of the subject, it is thought best to publish at once the part relating to the newly discovered leaf miner in order that tobacco planters may be on their guard against what threatens to become the greatest pest of this crop. The remainder of the Bulletin will be ready later in the present year.

W. A. WITHERS,
Acting Director.

Approved for publication:
ALEX. Q. HOLLADAY, *President.*

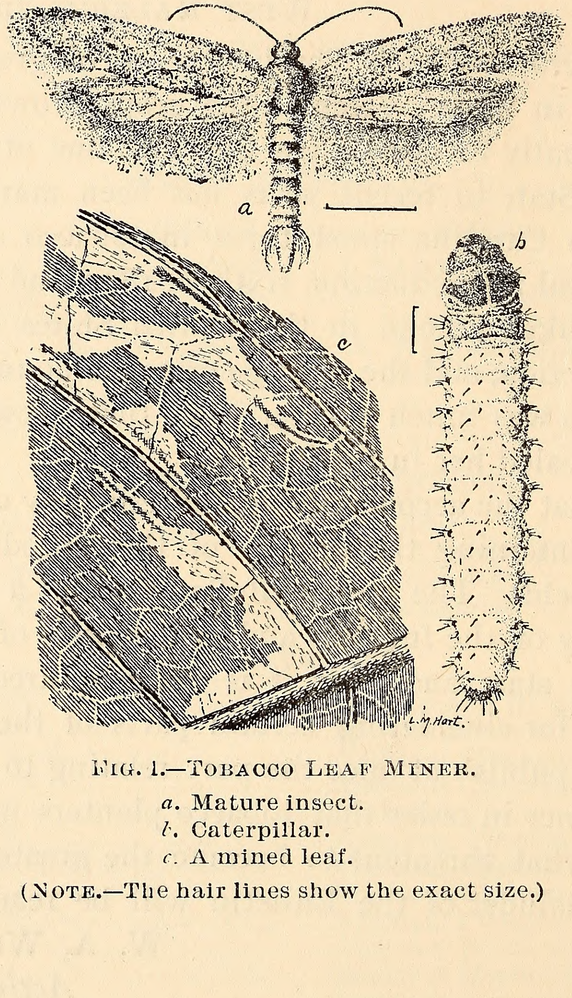


FIG. 1.—TOBACCO LEAF MINER.

a. Mature insect.
b. Caterpillar.
c. A mined leaf.

(NOTE.—The hair lines show the exact size.)

A NEW TOBACCO PEST.

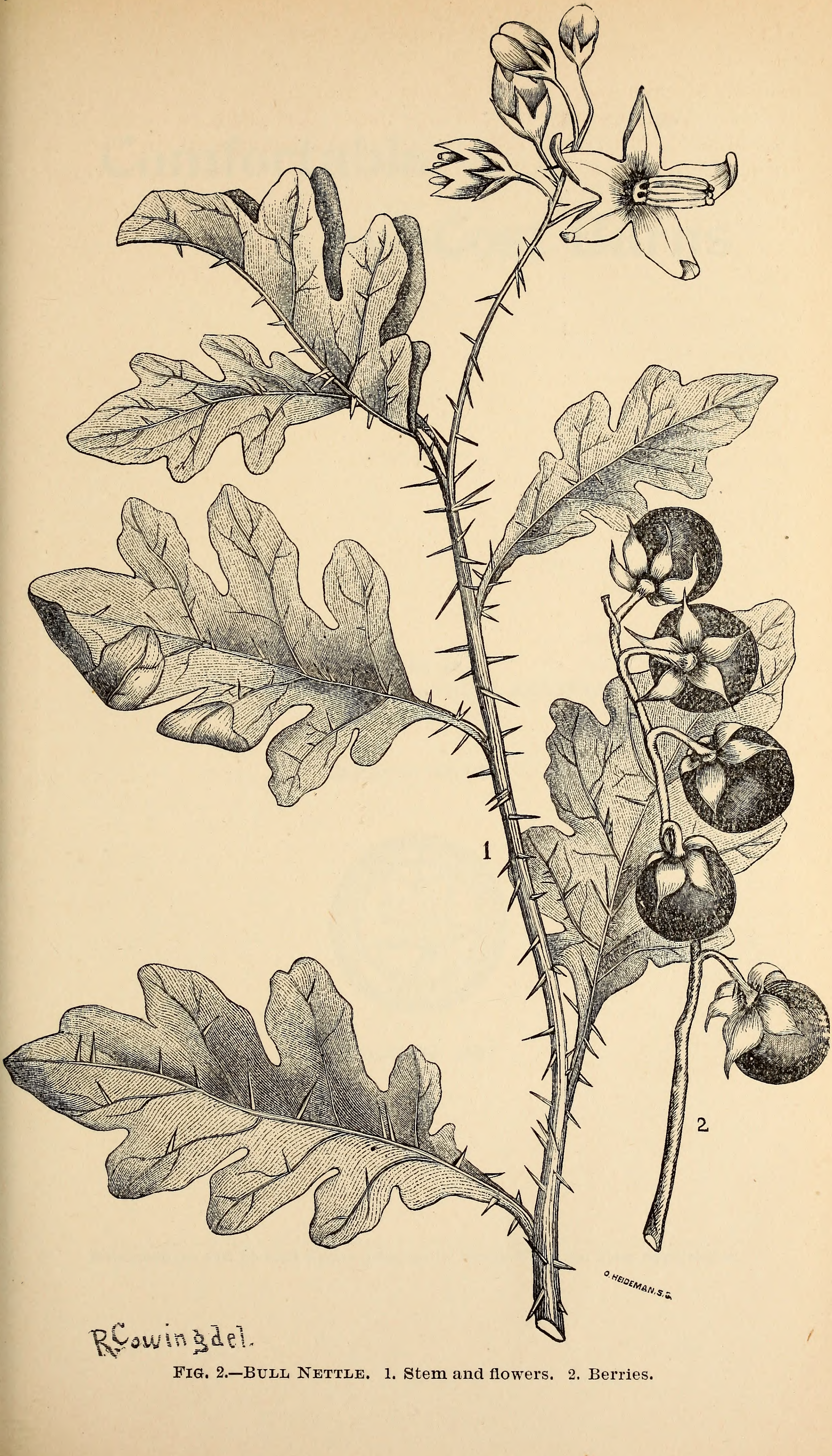
BY GERALD McCARTHY, ENTOMOLOGIST.

A new insect pest of tobacco has appeared in North Carolina. This insect, *Gelechia picipelis*, Zett., is a native moth whose common food plant has been the perennial solonaceous weed, *Solanum carolinense*, commonly called horse or bull nettle. This weed is rather common on dry, sandy soil from Connecticut southward along the coast to Florida, and westward to the Mississippi. This plant is usually one foot high, with angular-toothed, petiolate leaves, three to five inches long, with straight yellow prickles. Flowers blue or white. The range of the insect is co-extensive with that of its host plant, and includes, as we see, nearly the entire tobacco growing area of the United States. While this insect probably inhabited its present range prior to the coming of the white man, it has never been recorded as a pest of tobacco until the year 1896. So far as present data shows the damage to tobacco is serious only in three townships of one county in North Carolina, and to a large but undetermined district in Florida. The above mentioned county does not lie in the tobacco belt of the State, but in the region chiefly devoted to trucking. This region is also that in which the bull nettle is most common. The damage so far is not considerable, but the people are alarmed for the future. It is well known to economic entomologists that the natural increase of any insect is chiefly regulated by the abundance of its food plants. Insects which subsist upon one or a few species of weeds of waste ground must necessarily lead a very precarious existence, and do well if they hold their numbers from year to year. When such an insect changes its wild food plant for a cultivated species, the relatively almost infinite abundance of the latter causes a parallel increase of the insect, which, soon overflowing its natural boundaries, or the range it occupied before, spreads into all regions where the new host plant is cultivated. This has been the history of the Colorado potato beetle, which originally subsisted upon another solonaceous weed closely related to the bull nettle.

DESCRIPTION OF THE TOBACCO MINER.

Gelechia picipelis, Zett.—General color yellowish gray. Head and chest paler than wings, inclining to cream color. Palpi simple, not exceeding the vertex. Primaries variegated with a few smoky streaks and a marginal row of minute black dots at base of ciliae. Wing expanse 0.45 to 0.50 inch. Length 0.20 inch. (After Miss M. Murtfeldt, 1881). The insect belongs to the natural order Lepidoptera, sub order of Moths, family of Tineids, of which the more important are the clothes and fur moths and the Angoumois grain moth or "Fly-weevil," *Gelechia* (*Sitotroga*) *cerealella*, so destructive to corn and other grains in the crib. The latter species is very closely related to and greatly resembles our tobacco miner.

Remedies: None have been tried as yet. From the nature of the case the treatment must be preventive. The parent moth deposits her eggs within the substance of the leaf or stem of the plant. The resulting caterpillar eats the green matter of the leaf, leaving both skins intact. The skins of the tobacco leaf are oily and able to shed any liquid. They also prevent any powder dusted on the leaf from coming into contact with the enclosed caterpillar. When full grown the caterpillar drops to the ground, spins a small, silky cocoon under leaves or trash of any kind, or even stones or clods, and there remains dormant for a week or ten days, after which period the winged moth issues from the cocoon and begins to lay eggs for the succeeding brood. The number of annual generations is as yet not known, but is probably not less than three nor more than five. The insect is believed to hibernate, in the imago or winged state, beneath trash in the field and about tobacco barns. It may also lie dormant, either as caterpillar or pupa, hidden in the stumps of tobacco or the roots of the bull nettle, but so far no larvæ or pupæ have been found during the winter. The most promising remedy at present is the extirpation of the bull nettle in all tobacco-growing sections, and the prompt plowing under or removal of tobacco stumps as soon as the crop has been gathered. Clean cultivation of the growing crop, with frequent stirring of the soil close up to the plants, will destroy the dormant pupa or cover them so deep that the moth will be unable to find its way to the surface of the ground. A close watch should be kept, and when blotch mines are seen on leaves the enclosed caterpillar may be easily crushed between thumb and finger. The leaves will then soon repair the damage. Trap lights burnt in the field from dusk till 10 P. M. will attract and destroy large numbers of the moth.


1
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O. HEIDEMAN, S.C.
R. Cowing del.

FIG. 2.—BULL NETTLE. 1. Stem and flowers. 2. Berries.

Comfortable Low-Cost Barns

ISSUED BY
THE NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION
RALEIGH, N. C.

BULLETIN NO. 142

AUGUST 23, 1897

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The Station is glad to receive any inquiries on agricultural subjects *Address all communications to the Agricultural Experiment Station, and not to individuals.* They will be referred to the members of the Station staff most competent to answer them.

The accompanying paper was prepared for publication as Bulletin No. 134, but it was thought best, after its preparation, to reserve it for further treatment. It is now offered for publication as Bulletin No. 142.

On account of our mild winters, the idea seems to prevail that very little care is necessary for the protection of stock and cattle in this State. This idea is erroneous, and we find striking proof of it on examining the reports of the statistician of the United States Department of Agriculture, which are compiled from the returns of the farmers themselves. During 1896 the loss of cattle from winter exposure is estimated at 2.3 per cent., and of sheep 3 per cent., the two amounting annually to about $175,000. If we add also the injury which must necessarily come to stock and hogs, the loss for the year will practically amount to as much as the entire State tax on farming lands.

In the New England and Northwestern States, where it is absolutely necessary to provide good barns, the loss from winter exposure amounts practically to nothing. If in those sections good barns pay well, notwithstanding the necessity of greater care in their construction, they would seem, to a much greater degree, to be a good investment in this State, where much less care will be needed.

The title of this bulletin, "Comfortable Low-Cost Barns," has been selected to cover several plans which have been adopted to make comfortable, cheap places to house stock in this climate. They are more or less convenient. By use they have been demonstrated to be desirable, except in the case of the circular form presented, which has not been tested by use here. This is a compact form. There are many advantages and few disadvantages in having such a barn. Cost of material and economy of space inclosed are among the leading points in favor of this plan. Economy in handling and feeding stock from the centrally located silo is a leading feature.

Some conveniences in feeding-boxes and safe fastenings for doors are figured and described, and there are cuts of home-made cattle fastenings, which are also described clearly enough for anyone to be able to make them at home. It is hoped these may prove of sufficient interest and value to the Station's constituents to warrant having called attention to them in this manner.

August 23, 1897. W. A. WITHERS,
Acting Director.

Publication approved.
ALEX. Q. HOLLADAY, *President.*

Comfortable Low-Cost Barns.

FRANK E. EMERY, AGRICULTURIST.

I. CHEAP SMALL BARN FOR A CORRESPONDENT.

> DEAR SIR: You wish to know the amount of stock which is intended to be kept, and how much money I wish to put into the barn about which I wrote you. Would like to house, say, two horses and two cows, and have room for the coarse food from a one-horse farm; to cost, for material only, about $25. Lumber is fifty cents per hundred feet, and shingles $1.50 per thousand. No cotton is to be grown.
>
> *McAdensville, N. C.* J. S. F.

It is not easy to make a satisfactory barn for the low cost desired by J. S. F. If, in an estimate for a plan which he approves, we overrun that amount, will he not be willing to accept a trifle more cost for a better and more convenient building than that will pay for? The plan here proposed is for a stable 30 feet by 20 feet, with 12-feet posts, and the second floor put in to give 8½ feet in the clear on the ground floor. The stalls are to occupy 10 feet by 30 feet of the building, while the passage, wagons and storage occupy the remainder of the main floor. There will be storage for hay and fodder in the loft. This barn can be built in three bands, or bents, one of which could be devoted to stable, one to storage, and the middle one to passage, wagons, etc. In order to reduce cost of enclosing, we put the stalls and storage all on one side (the north), and make the passage and vehicle storage through and in the south side. The south-side wall may be covered with slats, and doors put at the ends, or, if desired, the ends may be tightly boarded and the entrance may be on the south. With this last arrangement the roof could be extended out over a lean-to shed, and increase storage and floor space considerably at small cost. (See dotted area on plan herewith, and below, p. 7.)

The bill of lumber required for the 20-by-30-feet structure, with slat doors and slat covering on south side, is about as follows, with cost carried out for each item:

3 sills, 5 x 6 x 30 feet	225	square feet.	$1.13
2 sills, 5 x 6 x 20 feet	100	"	.50
3 sills, 5 x 6 x 10 feet	75	"	.38
12 posts, 4 x 6 x 12 feet	288	"	1.44
8 plates, 2 x 4 x 16 feet	86	"	.43
4 plates, 2 x 4 x 20 feet	53	"	.27

7 girts, 4 x 4 x 10 feet	94	square feet.	$0.47
3 pieces, 4 x 4 x 16 feet (braces)	64	"	.32
10 pieces (girts), 2 x 4 x 10 feet	67	"	.34
24 rafters, 2 x 5 x 15 feet	300	"	1.50
24 collar-beams, 1 x 5 x 12 feet	120	"	.60
60 pieces (boarding three sides), 1 x 12 x 13 feet	780	"	3.90
20 pieces (boarding gables), 1 x 12 x 12 feet	240	"	1.20
Roofing, 90 pieces, 1 x 4 x 16 feet	480	"	2.40
Slats for side and one-half end, 96 pieces, 1 x 4 x 13 feet	416	"	2.08
Floor joist, 4 pieces, 2 x 8 x 20 feet	107	"	.54
Floor plank, 48 pieces, 1 x 10 x 15 feet	600	"	3.00
4¾ thousand shingles, @ $1.50			7.13
For lumber (including shingles)	1,695	"	$27.63

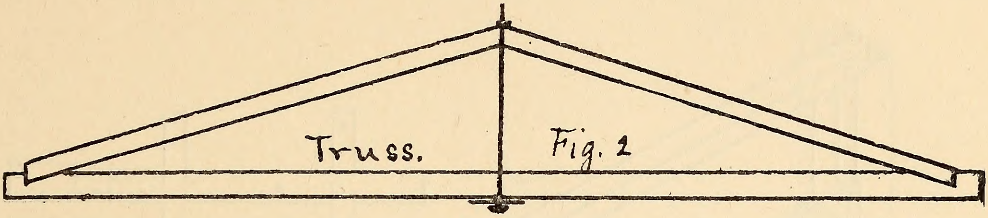
Hardware needed:

Pair 8-inch strap-hinges, with screws, for door in gable	$ 0.30	
Two pairs hinges, with screws, for large doors in slatted end	1.00	
Three pairs 8-inch strap-hinges for stall and back stable doors	.90	
Forty pounds various sizes of nails, @ 4 cents	1.60	
Twenty pounds shingle-nails, @ 4 cents	.80	
		4.60
Total		$32.23

The lumber slightly overruns what our correspondent desired to expend for the barn, and the hardware costs nearly five dollars ($5). This provides for covering and enclosing the barn, but does not include partitioning off or making mangers in the stalls. These may be as simple as desired by the builder, from smooth peeled poles up to tongued-and-grooved plank to reach to the floor overhead or to be only four or five feet high. A pole (or plank) division, open enough so animals can see each other, and about five feet high, is much to be preferred.

If 20 x 30 feet is not large enough by the small expense mentioned above, the roof could be run out on the south side ten feet and cover 30 x 30 feet. Then the entrance could be from the west, as shown at the left; and by making a truss-support for the floor overhead instead of the post at "a," make a truss (see cut at top) to hold floor, and drive out at middle of south side. This plan would largely increase the capacity of the barn, as well as its convenience. The dotted lines represent the addition, and the curved lines show the course wagons would take passing through the barn.

The stall doors may be sliding or hinged. The latter are to be preferred. Strap-hinges, with a home-made fastener, as shown in Figs. 3 and 4, are serviceable and safe. The mangers may be made like either of those shown at Fig. 3, or 5, for horses. At Fig. 5 is shown a stationary feed-box, drawn from one in use at the Experiment Farm stable. Fig. 3 shows the tilting manger, also in use at the Experiment Farm. This manger, or food-box, is made as follows: End pieces are made 38 inches long, 4 inches wide at one end and 2 feet wide at the other. They taper alike on



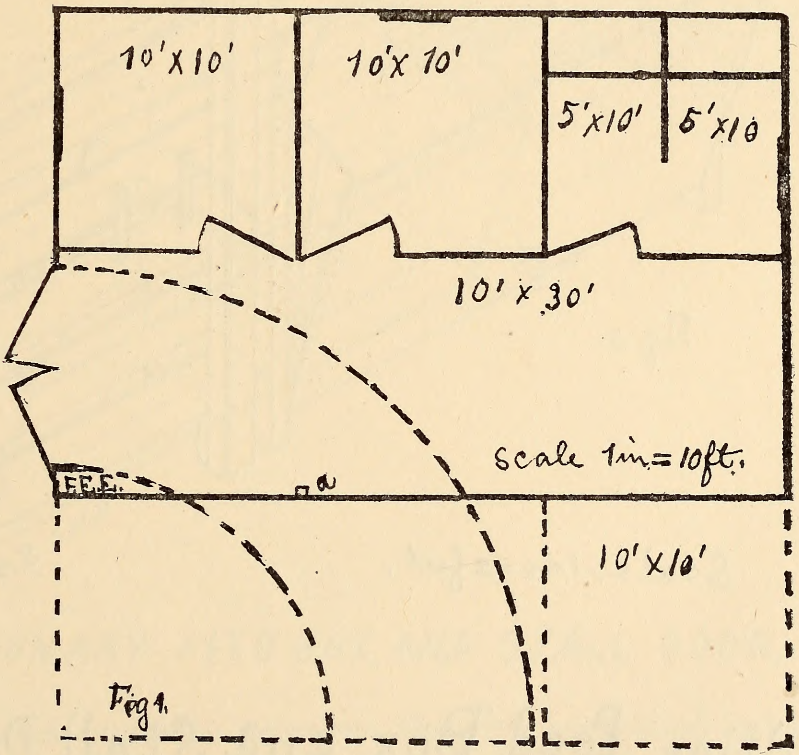
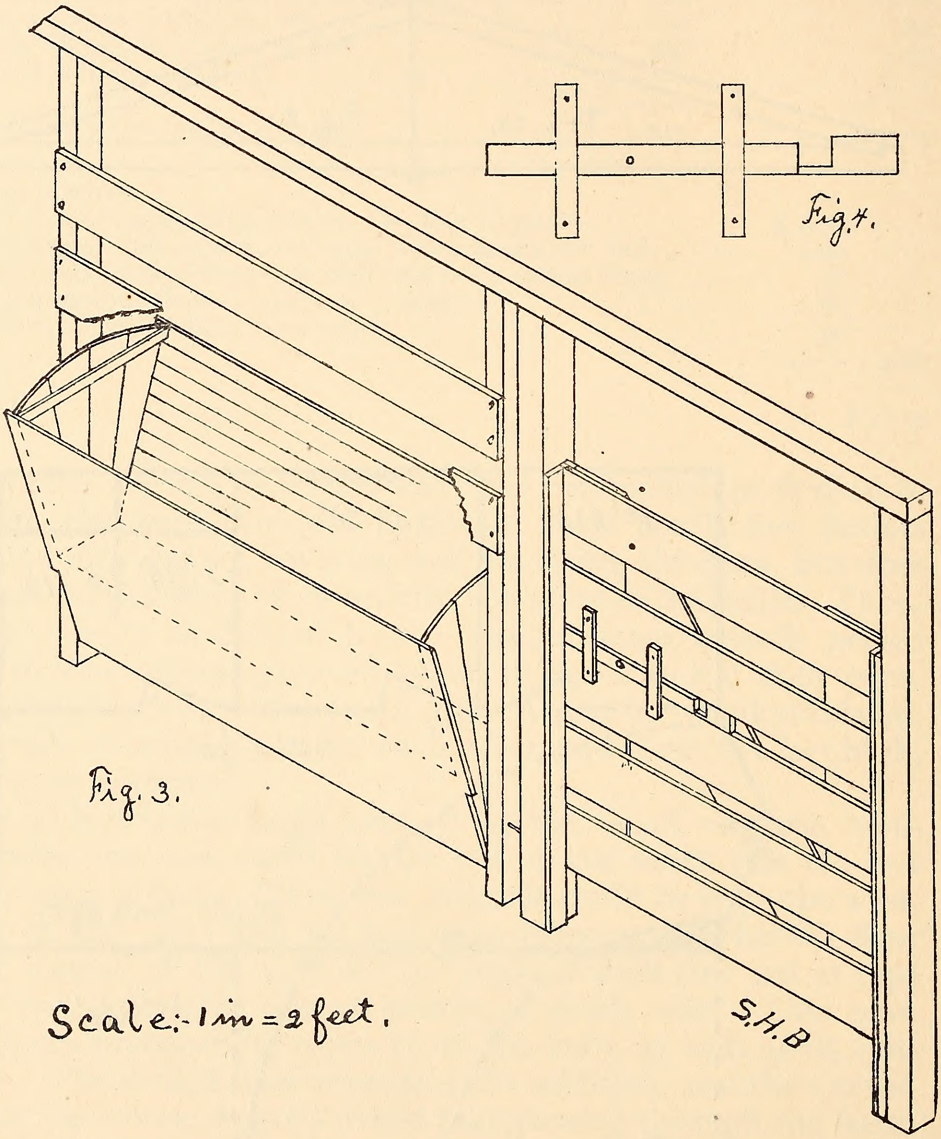


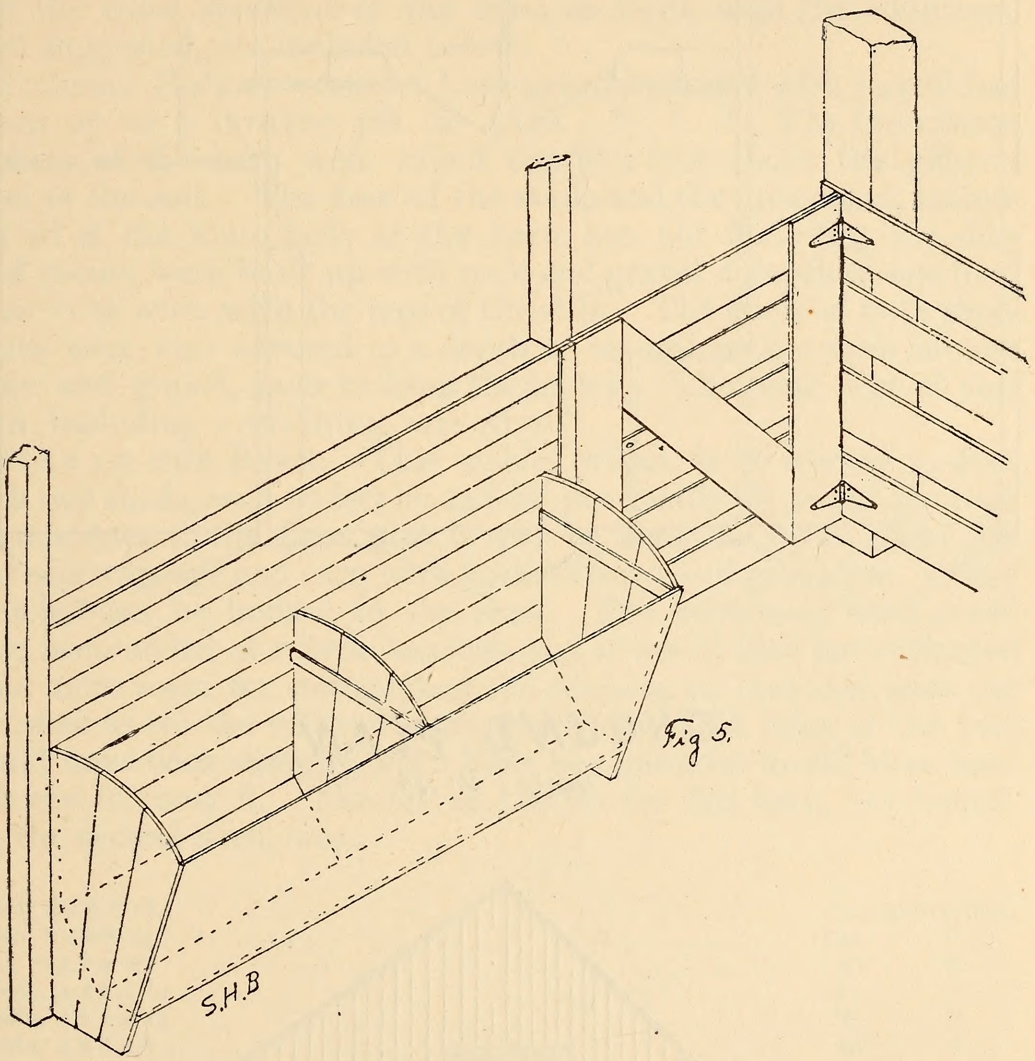
Diagram of Low=Cost Barn.

both sides. A cleat across, near the top, as shown in Fig. 3, is nailed on the side which is to be within the box. The bottom is 2 x 8 inches, as long as the manger is desired, and chamfered on the edges to match the tapir of the end pieces. It is nailed in at a height to just fill the ends and catch the sides with a good fit when they are nailed on. Under the bottom a 2 x 4 piece should be nailed to the ends and holes bored through end and block inside to firmly hold the pin of wood or iron which passes through the adjacent stud. It is on these pins at each end, or a rod or water-pipe long enough to pass through both, that the box rests to tilt from side to side. Set the ends as far apart as length of box is to be,

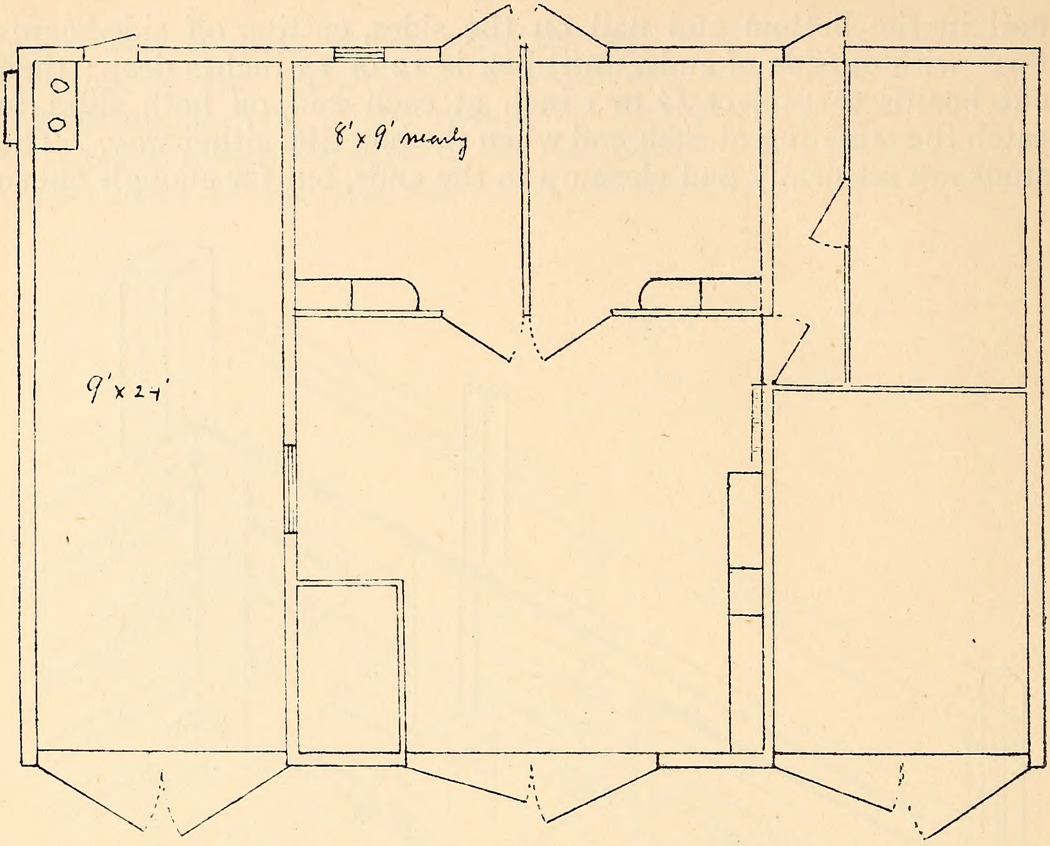


Tilting Feed Box and Stall Door.

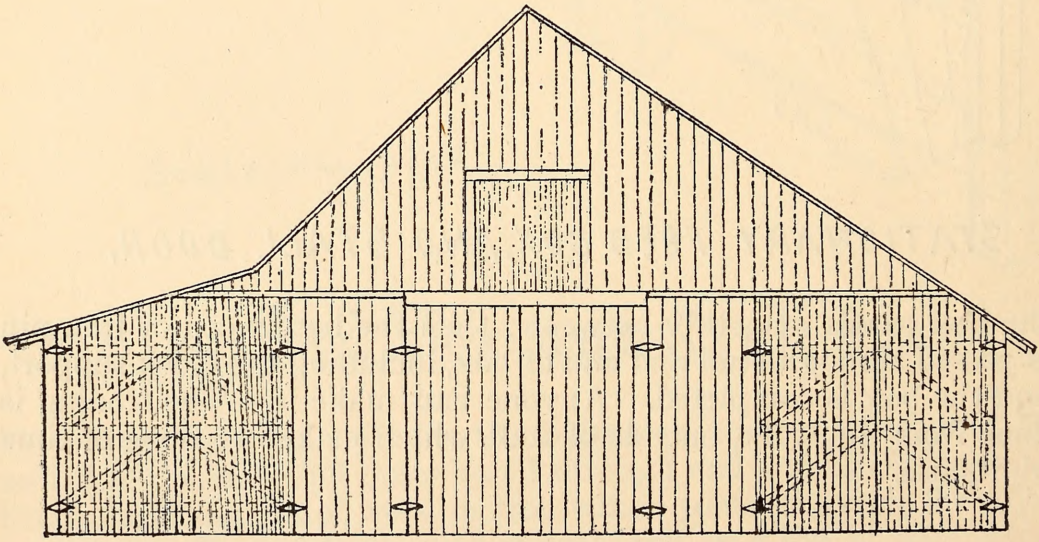
nail in the bottom and nail on the sides, cutting off side-boards flush with outside of ends, until box is 12 or 15 inches deep; then cut boards to project ½ to 1 inch at each end, on both sides, to catch the studding at each end when the box tilts either way. The studs are set firmly and close up to the ends, but far enough out so the box passes smoothly between; then the hard-wood or iron pin is passed through stud and end of box, including the block support, and the box is completed. Anyone can make it. The feeding is done from the walk, outside of stall, which makes a saving of time by its use.



STATIONARY FEED BOX, AND STALL DOOR.



GROUND PLAN
Scale 6': 1"



FRONT ELEVATION
Scale 6'=1"

II. BARN FOR THE STATE GEOLOGICAL SURVEY.

In 1895 this Station was called upon by Prof. J. A. Holmes, State Geologist, to furnish a plan for a convenient barn, of moderate cost, for the Geological Survey. Diagrams showing the ground plan and the front elevation of the barn, as built, with the additional shed suggested, are included below.

Professor Holmes wrote: "I am greatly pleased with it, and had it put up as a turnkey job for $128. * * * The foundation timbers of the barn were raised nearly a foot above the general level of the soil. The floor of the stalls and the ante-room, including all of the main body of the barn, but not including the side-shed rooms, were built up with rock and gravel a depth of one foot, so as to be even with the tops of the sills. The floors of both shed-rooms were also covered to a depth of several inches with broken stone and gravel, so as to keep them dry. The total cost of this barn, including everything, was $150."

Plan of the Barn.—This stable, proper, is 16 feet by 24 feet, with two sheds, each 10 feet by 24 feet, practically all under one roof. By reference to the floor plan it will be seen the main room has space for carriage and cart, with harness-room and grain-bin. Other vehicles can be housed in the shed. The additional shed could have been added at a little less cost, and it would then have afforded some more room for storage, had the timbers for that side been cut the same as for the other side, in which case both sides of the roof would have been straight, and a little less material would have been required to cover it. The bill of lumber for this barn, not including the second shed, was:

3 sills, 6 x 6 x 16	144	square feet.
2 sills, 6 x 6 x 24	144	"
1 sill, 6 x 6 x 10	30	"
3 posts, 4 x 6 x 12	72	"
4 posts, 4 x 6 x 14	84	"
3 posts, 4 x 6 x 8	48	"
4 plates, 2 x 4 x 16	43	"
4 plates, 4 x 4 x 24	64	"
1 piece (ridge), 1 x 8 x 24	16	"
13 rafters, 2 x 6 x 13	169	"
13 rafters, 2 x 6 x 23½	306	"
13 collar-beams, 1 x 6 x 10	65	"
13 floor joists, 2 x 9 x 16	312	"
9 pieces (braces), 3 x 4 x 15	135	"
2 stall partitions, 4 x 5 x 15	33	"
Roof-boards, 56 pieces, 1 x 4 x 24; or 84 pieces, 1 x 4 x 16	448	"
Gables and carriage-room	650	"
78 slats at horse-stalls, 1 x 3 x 9	179	"
6 pieces horse-stable, 1 x 10 x 10	50	"
Lumber for 4 doors	163	"
Timber (permanent stalls), 6 pieces, 2 x 10 x 6	60	"
Temporary stalls, 10 pieces, 2 x 10 x 9	150	"

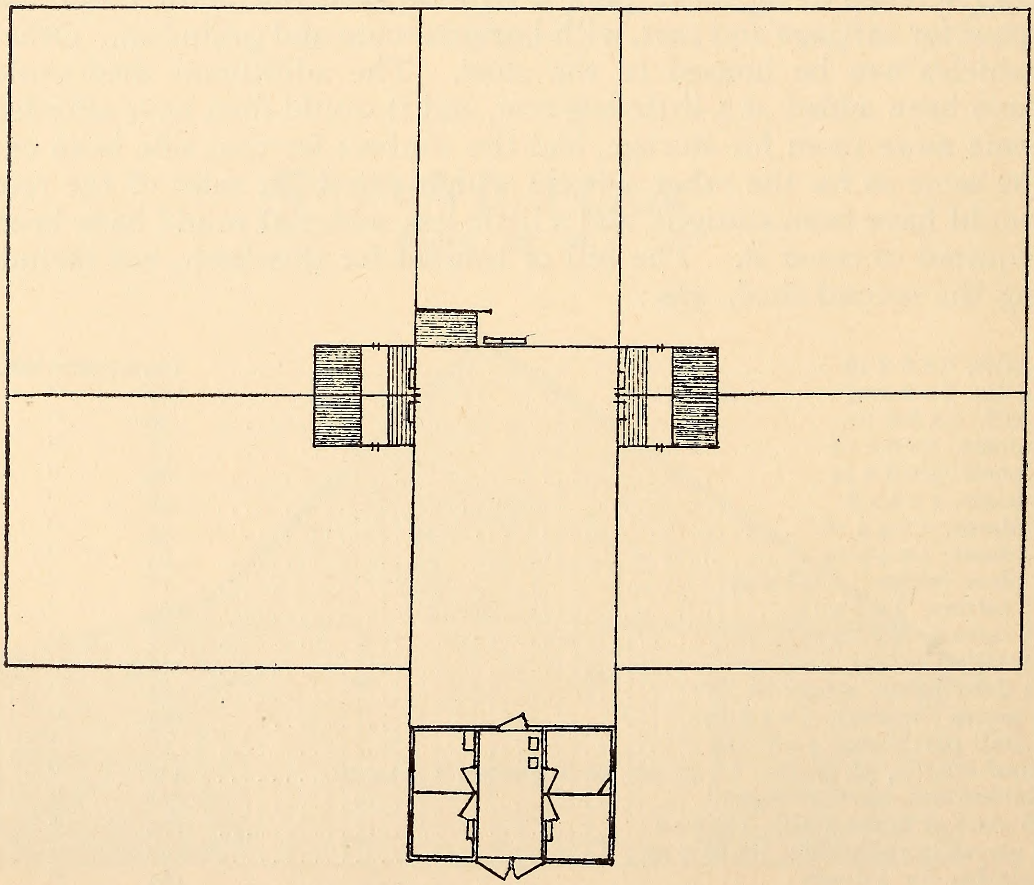
Permanent stall doors	37	square feet.
⅞ in. matched for harness closet, 1¼ area	124	"
Feed-boxes	43	"
13 pieces, 1 x 10 x 11 feet (floor joist in shed)	120	"
Floor in shed loft, five feet of shed and rise to roof	180	"
Partition stable from front room, 19 pieces, 1 x 10 x 9 feet	200	"
Grain-boxes in side of main room	70	"
1¼ in floor for front room	600	"
15 pieces, 2 x 10 x 15 (floor joists)	375	"
	4,592	"

7½ thousand shingles.

To change the plan enough to make the roof straight over the second shed would require 6 posts 14 feet long, and 26 rafters 23½ feet long, and to drop out the corresponding 3 posts 12 feet long and 13 rafters 13 feet long; then other lumber, enough to cover the shed, besides to supply posts and braces, would be needed.

III. STILL ANOTHER CHEAP BARN.

The writer has a small barn, 20 x 30 feet, for stock, which covers a central floor space 10 x 20 feet and contains four box-stalls 10 x 10



PLAN OF BARN AND YARDS.

Scale 25" = 1"

feet each. These stalls could be divided to hold two horses or two cows each, or three young cattle, if tied up. They are, however, in use as cow or horse stalls, and sometimes for sow and young pigs. The floor is of soil, raised a little to keep it dry. A loft overhead holds considerable forage, but there is little room for tools. A lean-to shed across one end, 30 x 12 or 14 feet, would supply this room at small cost. This plan is easy to extend by an additional bent, or more as may be needed.

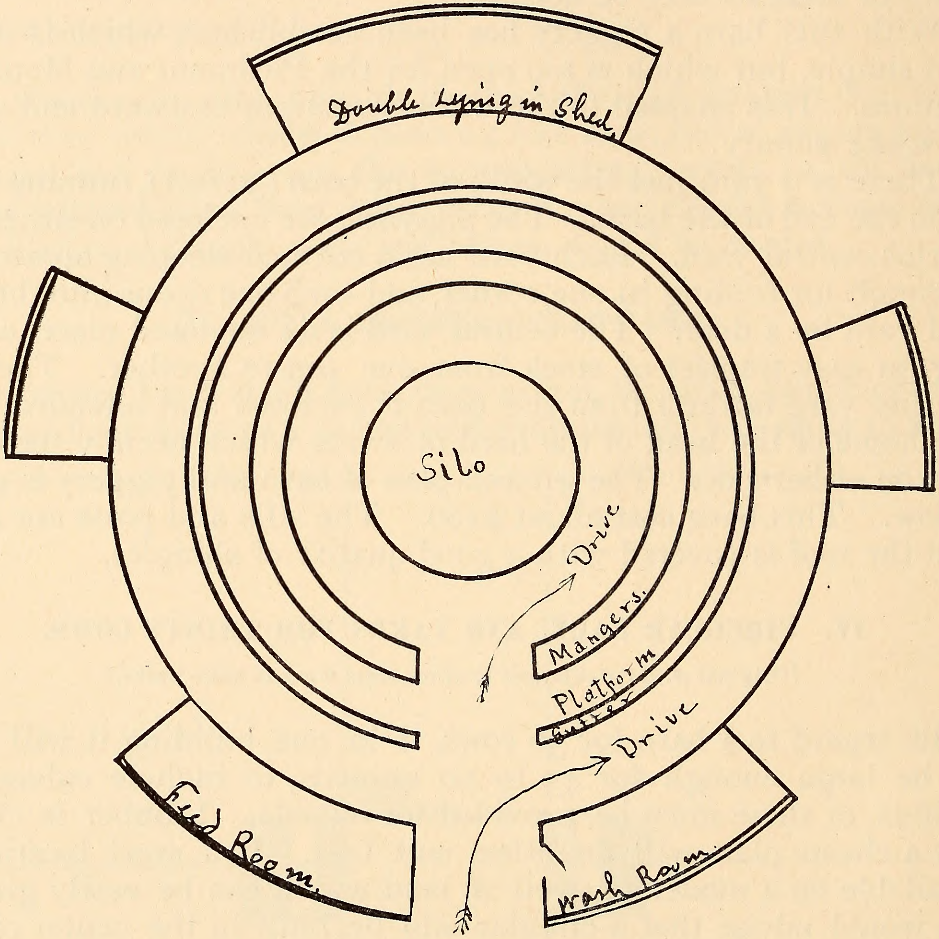
With this barn a piggery has been established, which is cheap and simple, but which is too open for the Piedmont and Mountain sections. It is adapted to the warmer sections eastward and south of Wake county.

There is a yard just the width of the barn (30 feet), running back from the end of the barn. The pig-yards are enclosed on either side of this central yard. Each yard has a covered sleeping apartment, a trough for feeding in one corner, and each one opens into the central yard by a door. The central yard is an enclosed place, allowing for easy transfer of stock from one pen to another. The end of this yard farthest from the barn is enclosed and intended to be the home of the head of the herd of swine which occupy the quarters on either side. The ground plan of barn and piggery is given below. This barn cost about $100. The sills and posts are 4 x 8, and the roof is covered with a good quality of shingles.

IV. CIRCULAR BARN, AND YARDS FOR THIRTY COWS.

(Original slightly enlarged to allow team work in barn-walks.)

In regard to a barn for 30 cows, if in one building it will need to be large enough for 45 to 50 animals, to include calves and heifers, or these must be provided for outside. Lumber is cheap, yet a cheap plan will doubtless suit best. If a good location is available on a moderate swell of land which can be easily graded, we would advise that a circular silo be built in the center of the location, 20 feet in diameter and 20 feet high, for 30 cows, or 30 feet high for young stock and teams in addition to cows; then build the cow barn, or shed, around the silo. With an 8-foot walk around the silo, 3-foot mangers, 5-foot platform for cows to stand on, and a 7½-foot walk behind cows, outside of a 1½-foot gutter for manure, would make a barn 70 feet in diameter. It would be best to make the barn of the diameter indicated, and widen the walks in front of and behind the cows, so a single wagon can be driven round to feed cows and to haul away manure at the least cost for handling. This form of barn is very compact and desirable. It can be built cheaply. No large timbers are required, and it seems to combine many of the ideal points of a good barn. For sheds in which to house tools, bulls, teams, calves and swine, it is suggested they be built in the form of segments of circles at a convenient distance from the barn, on the side of the prevailing winds, as partial shields from winds. For the stock which will live mostly in the yards, the calves and pigs, build on the side opposite the prevailing winds, and run their yards outside, to give larger yards, and retain sheds and feeding-places within easy reach from the cow-barn.



Floor Plan For Circular Barn.

On either side of the doorway rooms can be built, outside of the barn, for grain-feed and herdsman's room, and for a milk-separating room, from which the skimmed milk will be distributed to calves and pigs immediately after separation from the cream. Here will also be the wash-room for pails, etc.

At convenient points around the barn, between the windows, additional rooms will be handy for storing bedding and for lying-in stalls. They will be single, or double, and communicate with the outer passage of the barn by a door, and with the outside by slide-windows, set high up on the wall, or by doors, the top of which can be opened with the bottom closed, to let in light and air, or to fill with straw or other bedding material. Several of these are shown in the diagram. Washington is said to have built circular barns on account of the simplicity, cheapness and, perhaps, partly because of the pleasing variety of appearance, combined with the maximum of utility of form.

For detailed plans and advantages of a large circular barn the reader is referred to plan of barn designed and built by Professor King on a Wisconsin dairy-farm (Bulletin of Wisconsin Experiment Station, Madison, Wisconsin); also for details for the same and many other elaborate barn plans, to a book devoted to plans of barns for cattle, horses, sheep and swine (Barn-Building, by J. H. Sanders, Chicago, Illinois, published by J. H. Sanders Publishing Company.

Whatever the plan of barn adopted, it should be placed with a view to convenience of access and with reference to other buildings which may be built or needed in future, so the plan of the building plot will be pleasing to the eye. To this end barns are more frequently finished plain than ornamental. High peaks and lantern roofs are best omitted. The barn should rather be unassuming and plain, but neat, outside and in, and, if possible, be so constructed as not to be striking at first sight, but, on acquaintance, to carry the impression, which will deepen into conviction, that it is really a large shelter and storehouse, less appreciated at first than when its recesses have been explored and its adaptability to the purpose it was designed for are seen to be satisfactory.

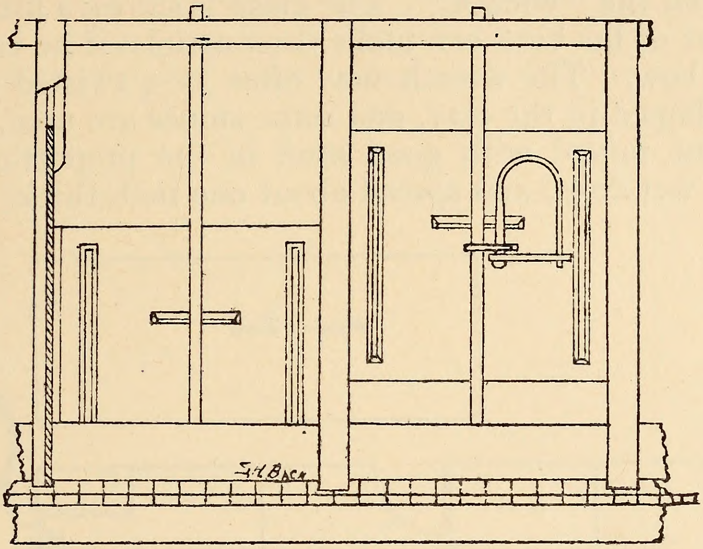
A barn, once built, is to remain a long time on the farm. It will help to give character to a place, and will either have a pleasing effect on the landscape and be a constant source of comfort and pleasure to its owner, or it will be an unsatisfactory eyesore, and mar the harmony of its surroundings. It is as easy to build the one as the other if forethought is taken. The location must be studied, the surroundings noted, and if any attempt at ornamentation is made it should be made to harmonize with other buildings in its vicinity. All ornaments should also be proportioned to the building of which they are to become a part. For instance, a cupola made too high, or too small in area, or one made large on a small barn, is inharmonious and ludicrous. The cupola is of service as a ventilator, and therefore not only ornamental, but useful. This cannot be said of many pieces and forms of ornaments which sometimes enliven the aspect of a barn, but which are more often expensive and troublesome encumbrances, soon falling out of repair and giving a forlorn and dilapidated appearance to a building which would not pertain to it but for the presence of the useless ornaments. Plain-finished barns, or those with a quiet, modest set of ornaments, like a cupola of harmonious size, or a latticed window in a gable, both serving the double purpose of ornament and use, should prevail. These will find favor with most people, and they will also convey a comfortable feeling of substantiality and adaptation to useful ends, which is the end and aim in these buildings.

V. NORTH CAROLINA EXPERIMENT FARM BARN.

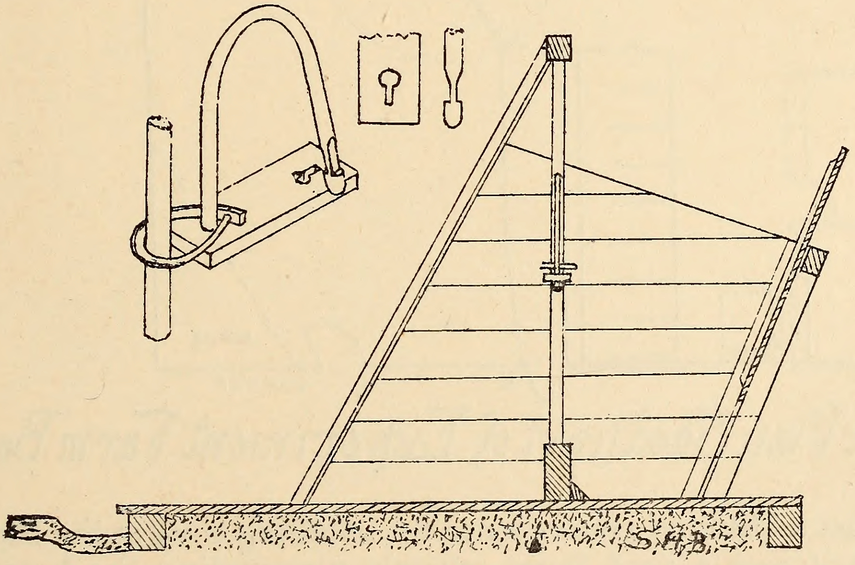
This barn was described and the floor-plan of both basement and main floor figured in Bulletin No. 68. The barn is quite satisfactory. We would rather, however, have the silo outside of the barn, and have the space it occupies for other uses. Since the large shed was shown in the Bulletin a considerable change has been wrought in the interior. It was originally a covered yard, all in one room, 50 by 70 feet. A platform and stanchions for tying eight cows or young cattle has been put in, in line with the seven, which can be tied up in the barn basement proper. Just at the west end of the walk, in the basement, but under the shed, a Fairbanks Standard scale, weighing from one-half pound to 3,500 pounds, and with a platform 4⅓ x 6¼ feet, has been in service over five years. On the south are two box-stalls, opposite the stanchions, and the same width of walk (ten feet) separates them as was made in the barn. The large opening, or doorway, has been moved further out from the barn and a nine-foot door put in at each end of the shed. On the west of the door, and opposite the two stalls, the walk and stanchions, are three large box-stalls. The alley behind the cows in the basement continues behind the cows in the shed, and, crossing the walk, or drive, at the end, passes the box-stall and a six-foot door, which opens out to the west, where is located a covered manure-pit, 14 x 38 feet. To the right of the walk is a covered yard and watering-trough. At the northeast corner of shed stands the 13,000-gallon cistern, which gathers its supply from the roof-gutters when it rains. This tank has been dry but twice in over six years, and one of those times it was necessary to draw out five or six thousand gallons of water in order to clean it out. The large stock which depends on this tank for supply, combined with the very protracted drought, dried the cistern in 1896, but only for a very short time.

The shed is high enough so a second floor put into the half nearest the barn gives a very large additional storage room, which is a little lower than the main floor of the barn and is reached from that floor by a large opening and an incline of about fifteen inches in four feet.

The interior of the large shed, hastily explained above, was planned for convenience and simplicity. It may be taken as a rather rough model, it is true, of what any farmer can make for his own convenience and the comfort of his stock. It is for this purpose barns are built, and here is one fairly comfortable—so plain in

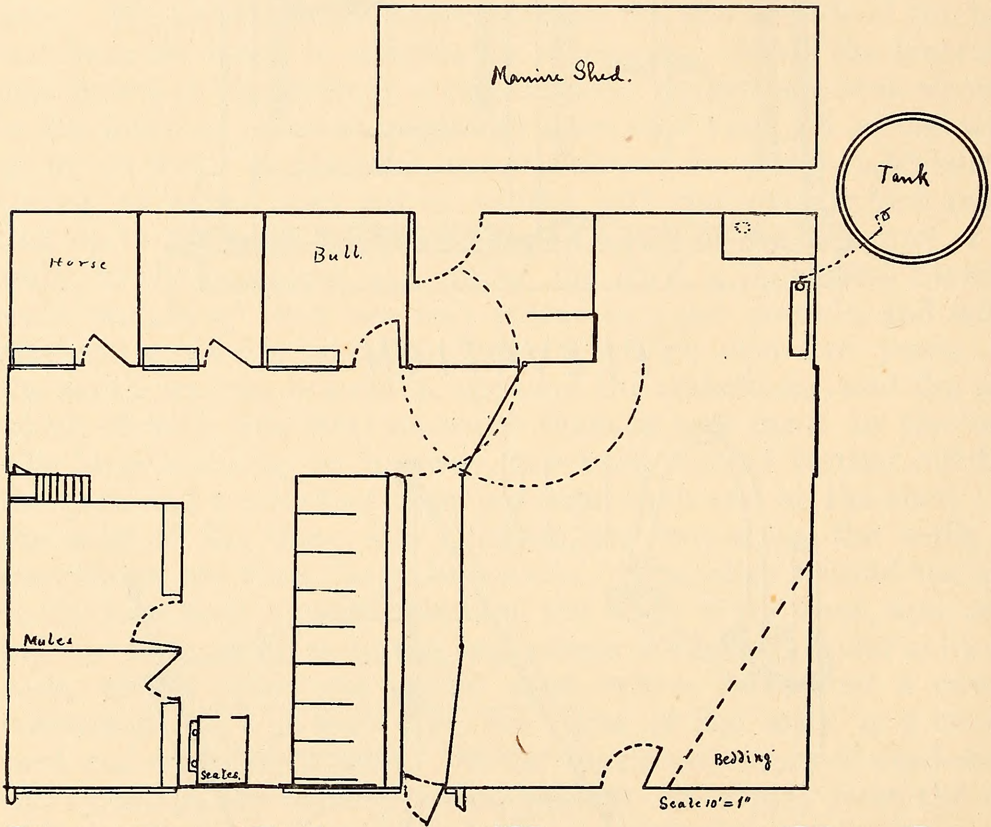


ELEVATION



CROSS SECTION

its plan and finish that any man who can read these lines can make a barn as good. The stalls are made of rough fencing. The floors are all clay, except the "tie-up," where cows are tied to stanchions. This floor is of plank, laid on cement grout, with timber to spike to, bedded at proper intervals. A cross-section of this platform and stanchion, with manger in front and cemented gutter behind, is seen on page 17. There is also shown in the end stall, and enlarged with the cross-section, a primitive bow for tying cows. This method has been much in use. The parts are the "bow," the "clasp" and the "wreath." The clasp is shown a little too heavy. Any farmer or his boys can make these articles if he can shape and steam the bow. The wreath may often be a twisted withe. The gutter is shaped in the clay, and some stones are used, then Rosendale cement, mixed with good sand in the proportion of one to three, and wet down and spread about one inch thick.



Floor Plan Shed part of Experiment Farm Barn.

The last additional convenience for handling cows at the Experiment Farm was a yard fence entirely surrounding the barn and shed and tank. Cows turned out can, by this addition, lie in shade or sun, and all have free access to the trough, which is kept supplied with water for their use. Droppings in the yard are taken up on a barrow and dumped on the pile in the pit as soon as cows are tied up to be milked. Chickens having access to the yard and pit, keep down the numbers of barn-flies to such an extent that no serious trouble is experienced from them. (See *press Bulletin* on this topic.)

Feeding Experiments,
Milk Records, etc.

ISSUED BY
THE NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION
RALEIGH, N. C.

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NORTH CAROLINA COLLEGE OF AGRICULTURE AND MECHANIC ARTS,

RALEIGH, N. C.

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The Station is glad to receive any inquiries on agricultural subjects *Address all communications to the Agricultural Experiment Station, and not to individuals.* They will be referred to the members of the Station staff most competent to answer them.

The accompanying bulletin relates to the feed, milk production and care of cows, and is offered with the hope that it will prove interesting to those who are studying these questions. The old plan of feeding was to give to stock not only enough feed for consumption, but a large quantity also to be trampled under foot. When the profits from farming were much larger than at present the loss was not so serious as it is now, although it was probably as great. It is the desire of the Experiment Station to call attention to the waste which comes from feeding a badly "balanced" ration, and to suggest a better and more economical proportion between the different feeding stuffs used. The first portion of the bulletin contains the results from feeding ordinary substances grown upon North Carolina farms, with the addition of easily obtainable substances such as corn silage, cotton seed meal, wheat bran, sweet potatoes, cotton seed, corn fodder, cow-pea meal and soybean silage, corn shucks, wheat-straw, &c. The conclusions are to be found on page 165, and the figures on pages 166 to 169, inclusive.

The second portion of the bulletin is also a feeding experiment, but in this case pigs are used instead of cows, and the feeding stuffs used are arranged with the object of contrasting skim-milk and buttermilk from cream (not from whole milk).

The third portion of the bulletin contains the record of milk and butter production of the Experiment Station herd during 1895 and 1896. There were difficulties to meet such as might be met by any dairyman. This of itself may prove a source of encouragement to one whose experiences may have been similar to ours. The interest for one who cannot make a sufficient outlay for the purchase of the more improved breeds of stock, may be increased upon learning that the herd was composed of common cows.

Some records of the temperature of the barn are shown, and also the readings of thermometer in a standard shelter, which show the barn of the Station to be very well suited for this climate.

The statistician of the United States Department of Agriculture (year book for 1896) estimates in round numbers the number of milch cows in North Carolina in January, 1897, at nearly 277,000, the oxen and other cattle 345,000, horses 146,000, mules 111,000, sheep 319,000, swine 1,456,000, making a total of 2,654,000 of farm animals. These animals are to be fed, and even a slight waste for each animal applied to the total number will make a loss to the State of a very great sum. If this waste is estimated at one dollar per year for each animal the annual loss for this State is $2,654,000, or if we put the loss at one cent per day for each animal the annual loss for the State will be nearly ten millions of dollars.

An explanation of the terms used in the feeding experiments will be found in Bulletin No. 106, which will be sent upon application.

The Station will be glad to answer any inquiries from any one who wishes to improve his method of feeding.

W. A. WITHERS,
Acting Director.

Publication approved:
ALEX. Q. HOLLADAY,
President.

FEEDING EXPERIMENTS, MILK RECORDS, Etc.

F. E. EMERY, Agriculturist.

COMPARATIVE EFFECT OF SOME RATIONS FED TO MILCH COWS.

At different times some Station cows have been fed experimentally on different combinations of foods at hand. The object in view has been to obtain some indication of the relative value or economy in the use of the combinations fed. In the trials detailed below the rations fed have been the most extensively-used winter rations of meal mixtures with silage, compared with some others compounded of such articles as North Carolina farmers raise in abundance, and which have been "balanced" by use of articles easily obtained by them. All the rations, except the preliminary and silage rations and the combination of hulls and meal, have been compounded for correspondents, and were fed here to observe their influence on the yield of milk. It is to be regretted that there were no fresher cows available for this experiment. Cow No. 5 was the only one which was yielding anything like a reasonable amount of milk. Her period of lactation began November 17, 1894. Dora McKee, the cow with the next longer period of lactation, had been milked since May 24, 1894, while cow No. 18 had been milked for nearly, and No. 19 quite, a year when this experiment was begun, in January, 1895.

The plan of this experiment makes each cow's record complete in itself, and no allowance need be made for natural decline in flow of milk, because the average time from the beginning of lactation is the same. Thus, in averaging, the first and fourth are set against the second and third for periods of equal length.

Previous to the first period of this experiment the cows were fed on corn silage and a meal ration of one part cotton-seed meal to two parts of wheat bran, by weight. The amount of this mixture allowed for each cow is usually fixed with regard to the amount of milk being produced, time of lactation, and individuality of the cows; but the silage is fed in quantities as great as the cows will consume with the grain allowed. During this winter the cows have been fed heavier than usual to hold them up in milk yield, because they were purposely held back in breeding. A preliminary period on this ration of silage and meal mixture, as long as those during which other combinations were to be fed, was taken for comparison. The yield of milk for this period, with per cent. of fat at its close, were determined, as well as the live weight of the cows. Of two rations to be compared, one was to be fed through one period; then the other ration would be fed through a double period, or twice as many days, after which the first ration would be fed again in another period. Averaging the yields from the two periods during which each ration was fed, should give a fair comparison between them, with no necessity of making an allowance for the advance in the period of lactation from one period on one ration to another period on the other ration.

The temperature, usually very mild here at Raleigh, did not vary more than usual during the progress of this feeding, and there was very even winter and spring temperature, except in the midst of the first period, when there was a marked cold wave, which was felt very decidedly here. The writer has observed the changes of winter weather to so affect the flow of milk from a herd of cows as to obscure the effect of considerable changes in rations.*

The yield of milk from all the cows fell off at the time of the lowest temperature, and Dora McKee and No. 5 lost a little more than did the others, which were being fed a ration which had already begun a reduction of the yield. This was helped somewhat by the cold weather, but it is not so marked because these cows were yielding so little. The maximum, mininum and mean temperatures were taken in the stable by a Draper's self-recording thermometer. This record is given on the following page.

Effect of Changes of Food.—In passing from the ration of the preliminary period, Dora McKee gained in both yield and total fat found per day, and held out so well through that period that, after being fed on it fourteen days, she was given more milk than before. Less milk was produced during the second period than in the first, but a gain was made in the third period on the same ration of silage and meal mixture as was fed during the second period. A still further gain was made in the fourth period, which seems to indicate the ration of sweet potatoes, raw cotton seed, pulled fodder and cowpea meal was an excellent one for milk and butter production. It will be noted, too, that this ration, while agreeing closer with the standard in dry matter, yet differs more from the standard in the larger amount of nutritive substance than does the ration of silage, which costs considerably less. The cost in this case was increased about one-third, while production of butter fat was increased about one-fifth when the cow was yielding one gallon of milk per day and from ten to thirteen ounces of butter fat, varying from eleven to fourteen or fifteen ounces of butter per day.

Cow No. 5.—The ration fed this cow differed from the above, in that corn shucks took the place of fodder, and the meal was a mixture consisting of cotton-seed meal, six parts; corn meal, two parts; and cowpea meal, one part, against raw cotton seed and cowpea meal in the other ration. The cost here was practically the same as that of the silage, cotton-seed meal and wheat bran ration fed in

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* Houghton Farm (Mountainville, N. Y.) Feeding Experiment.

TEMPERATURE IN EXPERIMENT-FARM BARN.

PRELIMINARY PERIOD.				FIRST PERIOD.				SECOND PERIOD.				THIRD PERIOD.				FOURTH PERIOD.			
	TEMPERATURE.				TEMPERATURE.				TEMPERATURE.				TEMPERATURE.				TEMPERATURE.		
	Max.	Min.	Mean.		Max.	Min.	Mean.		Max.	Min.	Mean.		Max.	Min.	Mean.		Max.	Min.	Mean.
Jan. 18, 1895	52.5	39.5	46.	Feb. 1	45.5	38.5	42.	Feb. 15	36.5	29.5	33.	March 1	69.	56.5	63.	March 15	60.5	55.5	58.
" 19, "	54.5	48.	51	" 2	45.5	37.5	40.5	" 16	35.5	33.5	34.	" 2	64.5	46.5	56.	" 16	62.5	38.	56.
" 20, "	47.5	39.5	44.	" 3	37.0	31.5	35.	" 17	43.5	35.	38.	" 3	51.	39.5	45.	" 17	47.5	35.	40.
" 21, "	57.5	46.	50.	" 4	44.	34.5	42.	" 18	44.5	33.5	39.	" 4	55.5	44.	50.	" 18	55.	40.5	47.
" 22, "	57.5	47.	51.	" 5	39.5	32.5	36.	" 19	44.5	37.	41.	" 5	50.5	39.5	46.	" 19	56.	45.5	52.
" 23, "	50.	38.5	44.	" 6	37.5	28.5	34.	" 20	44.	35.5	39	" 6	56.	42.	49	" 20	54.5	39.	48.
" 24, "	48.5	39.5	44.	" 7	37.0	18.0	31.	" 21	50.	38.5	43.	" 7	59.	54.5	57.	" 21	45.	33.5	39.
" 25, "	52.5	39.	42.	" 8	21.0	12.5	17.	" 22	46.	39.5	43.	" 8	58.5	52.5	57.	" 22	46.5	38.	42.
" 26, "	57.5	44.5	52.	" 9	29.5	16.	22.	" 23	44.5	35.5	40.	" 9	51.5	38.5	45.	" 23	51.5	39.5	44.
" 27, "	44.	37.	41.	" 10	31.5	24.	27.5	" 24	50.	36.5	43.	" 10	59.5	43.	50.	" 24	51.5	42.5	48.
" 28, "	44.	38.	42.	" 11	33.5	27.5	30.	" 25	57.	36.5	48.	" 11	54.5	50.	52.	" 25	57.5	49.5	54.
" 29, "	42.5	39.	41.	" 12	33.5	22.5	31.	" 26	52.	47.5	50	" 12	54.	49.	52.	" 26	55.5	50.	53.
" 30, "	44.5	41.5	43	" 13	29	20.5	24	" 27	54.	41.5	48	" 13	55.	51.5	53.	" 27	61.5	46.	53.
" 31, "	43.5	39.	41.	" 14	32.5	18.5	26.	" 28	62.5	49.	56	" 14	60.5	52.5	56.	" 28	70.	53.5	60.
			632.				438.0				595.				731	" 29	63.	46.5	56.
																" 30	74.	52.	62.
																" 31	52.5	49.	50.
																			862.
Av'ge or mean temperature.	....	....	45.		....	....	31.		....	....	42.		....	....	52.		....	....	51.

periods two and three. This cow had been milking two months when the preliminary period began, and was, in that period, the last part of January, yielding upward of twenty-five pounds (three gallons) of milk daily, and it was computed to contain over one pound of butter fat daily, or equal to 8¼ pounds of butter per week. There was a falling off in yield of both milk and butter fat at the end of the first period, but the gain before the cold wave, and after it, left the average yield of milk more than during the preliminary period. The yield continued to diminish to the end of the experiment; but, in spite of the falling off in milk, there was a gain in the yield of butter fat near the end of the third period; so the yield was practically the same as a month earlier at the end of the preliminary period. The falling off in yield of milk continued in the fourth period. In the average there is practical equality of yields, with the balance in favor of the ration of silage, cotton-seed meal and wheat bran.

Cows Nos. 18 and 19.—These cows were fed alike. They were far along in lactation, and their yields of milk and butter fat were small. A ration of low cost, and yet one to encourage production of milk, was desired. They were not to come fresh in milk until late summer, and must pay as large a part of cost of keeping during this winter and spring as possible. They were fed cotton-seed hulls and meal for two periods. This is about the lowest-cost ration which can be found in the vicinity of the oil-mills. Farther from these mills the rations which require only the cotton-seed meal to be brought to the farm, and which may have been obtained by exchanging seed for it, may be the cheaper ration. At least, it is poor economy to buy and freight any coarse material when we have cornstalks, shucks and straw in abundant supply. In this ration of cotton-seed hulls and meal a ratio of nearly three and one-half of the former to one of meal was established and the cows given all they would eat at that rate. They would have taken much more meal, but it was withheld to induce them to consume the proportions desired. The digestible portion of the ration is given as calculated by the common method, like the other rations and according to actual digestion results. Both cows decreased in yield on the change from corn silage, cotton-seed meal and wheat bran when they were fed cotton-seed hulls and meal. No. 18 more than recovered the loss when changed to the ration fed in period two, and held up very well during the third period. She fell off again some in the fourth period, but the flow of milk was still, at the end of the fourth period, the last of march, equal to what it was at the end of January on the ration for the preliminary period. Cows Nos. 18 and 19 show a considerable more loss during period one than did either of the others. They were yielding less milk, but the cotton-seed hulls and meal ration could not support the cows and supply as much milk as they had been producing before. The fall in temperature also helped to depress the yield in period one. No. 19 shows a greater loss in yield of milk in the fourth period than any other cow. From the near approach of the end of lactation this loss in yield was, perhaps, due as much as to the change of food. From this course, perhaps, cow No. 19 does not show the same result as does cow No. 18 from the same feeding. Although giving less milk with the hulls and meal ration, cow No. 18 yielded more butter fat during each period than from the ration fed in periods two and three. This difference amounted to fully two ounces per day. The lack of decided result from cow No. 19, and this positive one in favor of cotton-seed hulls and meal for production of butter, makes this point interesting for another trial. It seems as though there might have been practical agreement but for the interference of lactation by cow No. 19 drawing toward a close. The hulls and meal seem to lead for butter production, while for yield of milk they are inferior to the ration of corn shucks with wheat straw for the coarse part, and corn meal, ground wheat and more cotton-seed meal combined in rations as for periods two and three. Yet, given a quantity of shucks and straw, on any farm it would be a false policy to waste these and use hulls. Perhaps in some other combinations they may lead the hulls and meal, both for milk and butter production.

Conclusions.—1st. The ration of sweet potatoes, raw cotton-seed, pulled fodder and cowpea meal gave better results for cow Dora McKee than did corn and soy-bean silage and cotton-seed meal, with wheat bran mixed in ratio of one to two, by weight.

2d. The corn and soy-bean silage, with cotton-seed meal and wheat bran, gave a better result with cow No. 5 than did sweet potatoes and corn shucks, with a mixture of cotton-seed meal, corn meal and cowpea meal mixed in the proportions of six, two and one.

3d. Cotton-seed hulls and meal, for butter production, leads corn shucks and wheat straw with corn meal, ground wheat and cotton-seed meal mixed in proportions of two, three and five. The latter made the most milk, however. Cow No. 19 lost in the last period so much, the result was evened up and became indeterminate.

The tables of rations and rates of production of milk and butter fat are appended for those who may wish to see these figures :

Dora McKee.—*Rations Reduced to 1,000 Pounds Live Weight and Calculated to Digestible Constituents.*

NUMBER OF PERIOD.	KINDS OF FOOD.	Pounds Actually Eaten.	Total Dry Matter Per 1,000 Pounds.	DIGESTIBLE CONSTITUENTS. Protein, lbs.	Carbo-hydrates, lbs.	Fat, lbs.	Nutritive Substance, lbs.	Ratio. 1:—	Pounds of Milk Yield Per Day for Whole Period.	Pounds Milk Per Day Being Tested.	Pounds Butter Fat Found Per Day.
Preliminary . .	Corn silage	33.7	20.37	2.30	8.60	0.68	11.58	4.49	9.10	8.82	.6238
	Cotton-seed meal and wheat bran, 1 to 2	9.0									
First Period . . .	Sweet potatoes	10.	25.11	3.00	15.20	1.45	19.65	6.27	9.46	9.55	.6897
	Raw cotton seed	5.									
	Pulled blade fodder (corn)	9.5									
	Cowpea meal	7.8									
Second Period	Corn and soy-bean silage	36.	22.92	2.64	9.66	0.78	13.08	4.4	9.03	9.23	.6257
	Cotton-seed meal, 1, to wheat bran, 2	10.									
Third Period . .	Corn and soy-bean silage	34.5	22.33	2.70	9.26	0.82	12.78	4.19	9.55	9.63	.648
	Cotton-seed meal, 1, to wheat bran, 2	10.									
Fourth Period.	Sweet potatoes	10.	24.31	2.91	13.66	1.28	17.85	5.8	10.07	10.37	.7753
	Raw cotton seed	5.									
	Pulled blade fodder (corn)	9¼									
	Cowpea meal	8.									
	Average first and fourth periods		24.71	2.955	14.43	1.365	18.75	6.035	9.765	9.96	.73
	Average second and third periods		22.63	2.67	9.46	.80	12.93	4.3	9.29	9.43	.6368

Cow No. 5.—*Rations Calculated to Digestible Constituents for 1,000 Pounds of Live Weight.*

NUMBER OF PERIOD.	KINDS OF FOOD.	Pounds Actually Eaten.	Total Dry Matter, lbs.	DIGESTIBLE CONSTITUENTS.				Ratio. 1:—	Pounds of Milk per Day for Whole Period.	Pounds of Milk Per Day at end of Period when Tested.	Pounds Butter Fat Found per Day.
				Protein, lbs.	Carbohydrates, lbs.	Fat, lbs.	Nutritive Substance, lbs.				
Preliminary	Corn silage	35.6	24.15	2.99	10.03	1.00	14.02	4.1	25.90	25.17	1.0092
	Mixture cotton-seed meal, 1, to wheat bran, 2	12.									
First Period	Sweet potatoes	10.	24.26	2.87	15.66	0.78	19.31	6.14	26.31	24.96	.938
	Corn shucks	11.88									
	Cotton-seed meal, 6	8.7									
	Corn meal, 2										
	Cowpea meal, 1										
Second Period	Corn and soy-bean silage	40.8	25.46	3.01	10.75	0.89	14.65	4.3	25.38	24.96	.938
	Mixture cotton-seed meal, 1, to wheat bran, 2	12.0									
Third Period	Corn and soy-bean silage	39.6	23.02	2.64	9 64	0.82	13.10	4.43	24.39	24.67	1.0083
	Mixture cotton-seed meal, 1, to wheat bran, 2	9.95									
Fourth Period	Sweet potatoes	10.	24.83	3.03	15 93	0.83	19.79	5.94	22.33	23.76	.95
	Corn shucks	11.6									
	Cotton-seed meal	6.									
	Corn meal	2.									
	Pea meal	1.									
	Average first and fourth periods		24 545	2.95	15.795	0.805	19.55	6.04	24.32	24.36	.944
	Average second and third periods		24 24	2 825	10.195	0.855	13.875	4.36	24.885	24.815	.973

COW NO. 18.—*Rations Calculated to Digestible Constituents for 1,000 Pounds Live Weight.*

NUMBER OF PERIOD.	KINDS OF FOOD.	Pounds Actually Eaten.	Total Dry Matter, lbs.	DIGESTIBLE CONSTITUENTS.				Ratio. 1:—	Pounds of Milk Yield per Day for Whole Period.	Pounds Milk Yield per Day, Last or Test Days.	Pounds Butter Fat Found per Day.
				Protein, lbs.	Carbo-hydrates, lbs.	Fat, lbs.	Nutritive Substance, lbs.				
Preliminary	Corn silage	26.4	19.11	2.57	7.88	0.74	11.19	3.83	8.89	8.33	.552
	Mixture cotton-seed meal, 1, to wheat bran, 2	11.									
First Period	Cotton-seed hulls	13½	17.47	*a*1.56	5.84	0.76	8.16	3.87	7.518	8.00	.6657
	Cotton-seed meal	4.		*b*1.44	7.14	0.78	9.36	6.32			
Second Period	Corn shucks	3.6	19.69	2.44	9.67	0.72	12.83	4.69	9.057	9.18	.585
	Wheat straw	5.8									
	Corn meal	2.0									
	Ground wheat	3.0									
	Cotton-seed meal	5.0									
Third Period	Corn shucks	3.88	20.44	2.46	10.07	0.68	13.21	4.80	8.836	9.00	.5543
	Wheat straw	6.20									
	Corn meal	2.00									
	Ground wheat	3.00									
	Cotton-seed meal	5.00									
Fourth Period	Cotton-seed hulls	13.5	17.15	*a*1.53	5.73	.745	8.005	3.87	8.286	8.75	.6972
	Cotton-seed meal	4.0		*b*1.41	6.99	.77	9.17	6.32			
	Average for first and fourth periods	......	17.31	*a*1.545 *b*1.425	5.785 7.065	.75 .775	8.08 9.265	3.87 6.32	7.902	8.375	.68145
	Average for second and third periods	......	20.065	2.45	9.87	0.70	13.02	4.745	8.947	9.09	.5697

a As rations are usually calculated. *b* On basis of actual digestion, 3 of hulls to 1 of meal.

Cow No. 19.—*Rations Calculated to Digestible Constituents for 1,000 Pounds Live Weight.*

NUMBER OF PERIOD.	KINDS OF FOOD.	Pounds Actually Eaten.	Total Dry Matter per 1,000 lbs.	DIGESTIBLE CONSTITUENTS.				Ratio. 1:—	Pounds of Milk Yield per Day for Whole Period.	Pounds of Milk per Day During Last Days of Test.	Pounds Butter Fat Found per Day.
				Protein, lbs.	Carbo-hydrates, lbs.	Fat, lbs.	Nutritive Substance, lbs.				
Preliminary	Corn silage	32.00	20.35	2.45	8.52	0.72	11.69	4.68	5.39	5.15	.3144
	Cotton-seed meal, 1, wheat bran, 2	10.00									
First Period	Cotton-seed hulls	13.5	17.83	*a*1.59	5.96	0.775	8.395	4.96	4.24	4.22	.3061
	Cotton-seed meal	4.20		*b*1.47	7.28	0.80	9.55	6.31			
Second Period	Corn shucks	3.8	18.10	2.50	9.10	0.69	12.29	4.34	5.76	5.82	.3244
	Wheat straw	3.5									
	Corn meal	2.0									
	Ground wheat	3.0									
	Cotton-seed meal	5.0									
Third Period	Corn shucks	4.13	19.13	2.51	9.64	0.69	12.84	4.53	5.10	4.54	.2697
	Wheat straw	4.15									
	Corn meal	2.00									
	Ground wheat	3.00									
	Cotton-seed meal	5.00									
Fourth Period	Cotton-seed hulls	9.6	13.20	*a*1.295	4.36	.60	6.255	4.53	3.57	3.92	.2615
	Cotton-seed meal	3.24		*b*1.16	5.305	.61	7.075	5.89			
	Average of first and fourth periods		15.52	*a*1.48	5.16	0.685	7.28	4.75	3.91	4.07	.2838
				*b*1.32	6.29	0.705	8.31	6.1			
	Average of second and third periods		18.645	2.505	9.37	0.69	12.565	4.4	5.40	5.18	.29755

IS SKIM, OR BUTTER MILK BEST FOR PIGS?

Fifteen thrifty young pigs were purchased for this trial to test separated or centrifugal skim milk, against buttermilk churned from sour cream for making pork. The pigs were farrowed September 4th and 11th. Their breeding by the two dams which were litter sisters was exactly alike. They were taken from the sows at six and seven weeks old and fed about what they would eat clean of a mixture of meals containing wheat middlings, and bran, corn, and linseed meals. The males were castrated while on dams. The pigs were fed as litters of eight and seven until November 19th, when four lots were made by weights. They were afterward marked so individual pigs could be known. About the first of December evidence of unthrift and parasitic worms were shown. Condition mixtures, of which some of the pigs ate freely, were made and kept in pens. It is probable that all pigs did not eat much of this, as some were not bettered by it; then iron sulphate was pulverized and mixed in the feed of the pigs frequently.

The condition mixture consisted of the following:

1 peck hard-wood ashes.
1 pint fine salt.
2 pounds copperas.
½ pound black antimony.
½ pound sulphur flowers.
1 peck charcoal.

These were intimately mixed, and some of it kept in a box in each of the yards. The pigs which ate of the mixture, so far as known, are the ones which continued to grow with the greatest regularity, yet the results seem to indicate that the parasites were the controling factor, so far as returns for milk fed were concerned. Late in December it became necessary to remove three pigs because of unthrift, and the remaining twelve were fed in four lots of three each through nine periods of ten to twelve days each.

These pigs kept in good form and grew moderately well. Frequently individuals were found to slacken in growth, and iron sulphate was then administered as above indicated as a vermifuge. Each lot of pigs had the run of a large pen, and were at liberty to root the yards as much as they pleased. Sufficient exercise was thus afforded.

The feed, after reducing to twelve pigs, consisted of wheat middlings of good quality, and skim milk which had been through the centrifugal separator, or buttermilk from cream which had been taken off by the separator, soured and churned quite exhaustively.

It was the intention to feed the same amount of middlings to all lots of three pigs; to feed skim and buttermilk in like amounts to different lots of pigs after they were separated the last of December. Pen No. 1 received a given amount of sweet skim milk, and Pen No. 2 twenty-five per cent. more, or five gallons for every four given to Pen No. 1. In the same way Pen No. 3 received the same amount of buttermilk that was fed Pen No. 1 of skim milk, and Pen No. 4 was given twenty-five per cent. more buttermilk than Pen No. 3 received, or as many pounds as was given Pen No. 2 of skim milk. The regularity of these amounts was several times broken into by lack of milk enough to supply all, especially of buttermilk, and a considerable amount of this was purchased from Cloverdale Farm, but it was of the same general quality, having been produced by the same methods of butter-making. Skim milk was needed at times, but was generally in full supply for calves and pigs. Thus the amounts differ somewhat. The pigs ate heartily, and gave so little trouble in the amount of waste that it was disregarded for Pens Nos. 1, 2 and 3, but Pen No. 4 made so much waste in the ninth period that it was taken out and was regarded as all middlings, although, having been wet with water, or milk, it was considerably overestimated.

The gains in live weight were seventeen to nineteen ounces per day and pig in the Pens 1, 2 and 3 during the whole of the nine periods to March 30th, whilst Pen No. 4 gained a little more than over fourteen and a half ounces per day and pig.

When these pigs were separated into lots they were an even thrifty looking bunch. Most of them grew along together well, as may be noted by the weights by pens. Nos. 1 and 2 were slaughtered soon after the close of the experiment. Pen No. 2 was slaughtered March 31st. It was composed of pigs No. 5, 200 days old, weight 156 pounds; after twenty-four hours' fasting 147½ pounds. No. 12, 207 days old, weight 154 pounds; after twenty-four hours' fasting 144 pounds. No. 14, 207 days old, weight 159 pounds; after twenty-four hours fasting 149½ pounds.

Pig No. 5 was dressed at Experiment Farm, the other two at a near-by slaughter-house, and the dressed weights reported back. The following table shows the percentages of dressed weight and waste before and after fasting:

	Dressed at Experiment Farm.	Dressed at Slaughter-pen.	
	Pig No. 5.	Pig No. 12	Pig No. 14.
Carcass in per cent. of first weight	75.64	72.72	71.07
Offal in per cent. of first weight	24.36	27.28	28.93
Carcass in per cent. of fasted weight	80.00	77.77	75.59
Offal in per cent. of fasted weight	20.00	22.23	24.41

Pen No. 1 went to slaughter-house April 2d, weighing 461 pounds. The dressed weight reported was 339 pounds, or about a medium between the percentage made by No. 5 and an average of the percentages made by Nos. 12 and 14.

The weights were taken early in the afternoon in all cases. The pigs were not fed at noon. Two feeds per day only were allowed, and thus it had been some hours since feeding. Under these conditions of feeding it would seem safe to discount about one-fonrth of the weight for offal, or if pigs are fasted twenty-four hours, to discount but one-fifth.

Pen A, consisting of the three pigs most infested by worms, was sold to private parties who rather have such a shote to feed than to buy a young one. They were not thrifty enough to feed well. Pen No. 3 was fed for several periods, but did not gain enough after the seventh to pay anything for skim milk fed.

Pen No. 4 did not pay for milk in either the 8th, 9th or 12th periods, but did pay in the 10th and 11th periods 20.7 and 16.1 cents respectively per hundred weight for the buttermilk fed.

The average dressed weight was 75.6 per cent. of afternoon weights.

An inspection of the table will show the amount of food, wheat middlings and skim or buttermilk fed during each period, the weight of each lot of three pigs at the end of each period, the gain made by the three during the period, and the amount of middlings and milk required by each lot in each period to produce one pound of gain in live weight. The last column shows the cents paid per 100 pounds for milk when there was gain enough during a period to pay anything. During the later periods the milk brought no return and the gain was insufficient to pay eighty-five cents per 100 pounds for wheat middlings consumed. It must be considered that at that price the feed merchant had the best of the trade.

Pen No. 1 paid 20.8 cents per 100 pounds for skim milk during nine periods covering ninety-four days. The pigs were about three and a half months old when this feeding began.

Pen No. 2, fed the same as to middlings, but which consumed 26.7 per cent. more skim milk than did Pen No. 1, paid 20.08 cents per 100 pounds for what was consumed during the same time, and under exactly like conditions as to housing.

Pen No. 3, consisting of three pigs fed on middlings and buttermilk, the same weights of middlings and buttermilk being fed as were fed Pen No. 1 of middlings and skim milk, paid 19.87 cents per 100 pounds of buttermilk fed during the nine periods covering ninety-four days. During seven periods covering seventy-four days the buttermilk was worth thirty cents per 100 pounds, but when carried forward to 121 days was worth only twelve cents per 100 pounds.

Pen No. 4, consisting of three pigs fed same as Pen. No. 3, except an excess of 20.07 per cent. of buttermilk over what Pen No. 3 consumed, paid 20.7 cents per 100 pounds for the buttermilk consnmed during seven periods covering seventy-four days. The buttermilk was dropped for this pen of pigs at the end of the seventh period. A record was kept through two later periods, the 8th and 9th, after which it was resumed again for three periods of seven, ten and ten days respectively. During the two periods of ten days each without buttermilk, but getting practically all the wheat middlings they could eat, the three pigs gained only four and twelve and a half pounds for the the three. Water was supplied in abundance. When buttermilk was fed again the gains were thirty-three and a half pounds in seven days, forty-one pounds in ten days, and ten pounds in ten days. On the whole feeding this pen of pigs paid 15.5 cents per 100 pounds for the buttermilk fed them as the calculations were made.

All the above calculations are based on dressed weight, eighty per cent. of the live weights of the pigs, and five cents per pound for dressed carcasses, or four cents per pound for live weight.

The pigs were found to dress an average of only 75.5 per cent. of the live weights. This reduces the actual amounts paid by each pen of pigs for skim and buttermilk to the following in cents per 100 pounds of milk:

	7 Periods.	9 Periods.	10 Periods.	12 Periods.
Pen No. 1, 3 pigs, fed skim milk.....	15.	17.	....	....
Pen No. 2, 3 pigs, fed 26.7 per cent. more skim milk than Pen No. 1....	20.17	16.78	....	....
Pen No. 3, 3 pigs, fed buttermilk.....	25.61	15.56	....	8.51
Pen No. 4, 3 pigs, fed 20.7 per cent. more buttermilk than Pen No 3....	17.86	....	12.30	....

The last column for each pig, in the table, showing the amounts received during each period for the skim milk and buttermilk on the basis of eighty per cent. dressed weight indicates something of what may be expected on that basis, and that percentage may be attained easily without the parasites to contend with.

There was, as noted above, a very great interference with growth by internal parasites. During those periods when the pigs made a thrifty advance in growth there is no reason to complain of the price of the milk, but whenever the parasites seemed to get a strong hold little or nothing was received for the milk, and the gain was not enough in some cases to pay for the other food. This shows swine breeders a danger to be guarded against. Pigs should be cleansed of the parasites and the yards changed often, and long enough to have the old places purified and the vermin exterminated.

For controling parasites see Bulletin No. 127.

TABLE I.

Number of Period.	Dates and Number of Days in Periods.	Pen 1—Three Pigs.							Pen 2—Three Pigss.						
		Wheat Middlings Fed	Skimmilk Fed.	Weight of Pigs at End of Period.	Gains During Each Period.	Required to Make 1 lb. of Gain in Live Weight.		Value of Milk in cts. per 100 lbs., Middlings at 85c. ₩ cwt.	Wheat Middlings Fed.	Skimmilk Fed.	Weight of Pigs at End of Period.	Gains During Each Period.	Required to Make 1 lb. of Gain in Live Weight.		Value of Milk in cts. per cwt., Middlings at 85c. per cwt.
						Wheat Middlings.	Skimmilk.						Wheat Middlings.	Skimmilk.	
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
1st	Dec. 26–Jan. 5 .... 10 ...	60.0	105.0	168.¾	25.5	2.35	4.01	49.94	61.5	131.75	179.¾	31.	19.8	4.25	54.52
2d	Jan. 5–16 .... 11....	81.0	148.0	197.¾	29.0	2.79	5.10	31.93	81.0	198.75	214 ½	34.75	2.33	5.72	35.31
3d	Jan. 16–27 .... 11....	99.0	198.0	232.¼	34.5	2.87	5.74	27.19	99.0	247.75	241.¾	27.25	3.63	9.09	10.06
4th	Jan. 27–Feb. 6 .... 10....	105.5	180.0	274.½	42.25	2.50	4.26	44.01	105.0	213.75	291.½	49.75	2.12	4.30	51.12
5th	Feb. 6–16 .... 10....	117.0	180.0	303.	28.5	4.10	6.32	8.15	117.0	225.0	319.½	28	4.18	8.04	5.56
6th	Feb. 16–26 .... 10....	127.5	180.0	337.¼	34.25	3.72	5.26	15.93	121.5	225.0	.....	.....	.....	.....	.....
7th	Feb. 26–March 10 .... 12....	165.75	216.0	361.	23.75	6.98	9.09	0.00	165.75	270.0	398.0	78.50	3.66	6.31	14.09
8th	March 10–20 .... 10....	140.0	180.0	404.½	43.5	3.22	4.14	30.51	140.0	225.0	424.	26.00	5.38	8.65	0.00
9th	March 20–30 .... 10....	152.0	177.0	449.	44.5	3.42	3.98	26.47	152.0	225.0	469.	45.0	3.38	5.00	22.54
		1047¾	1564.	......	......	3.43	5.12	20.8	1043¼	1962.	......	......	3.26	6.12	20.08

TABLE I.—*Continued.*

Number of Period.	Dates and Number of Days in Periods.	Pen 3—Three Pigs.							Pen 4—Three Pigs.						
		Wheat Middlings Fed.	Buttermilk Fed.	Weight of Pigs at End of Period.	Gains During Each Period.	Required to Make 1 lb. of Gain in Live Weight.		Value of Milk in cts. per 100 pounds, Middlings at 85 cents per cwt.	Wheat Middlings Fed.	Buttermilk Fed.	Weight of Pigs at End of Period.	Gains During Each Period.	Required to Make 1 lb. of Gain in Live Weight		Value of Milk in cts. per cwt, Middlings at 85 cts. per cwt.
						Wheat Middlings.	Butter-milk.						Wheat Middlings.	Butter-milk.	
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
1st	Dec. 26–Jan. 5........10....	61.5	93 0	161.¼	16.0	3.84	5.41	12.67	61.5	114.75	170.	31.50	1.95	3.64	64.35
2d	Jan. 5–16............11....	81.0	156.0	180.	18.75	4.32	8.32	5.14	81.0	190.25	204.¾	34.75	2.33	5.19	38.91
3d	Jan. 16–27...........11....	99.0	197.0	236.	56.0	1.77	3.52	70.89	99.0	239.0	228.¾	23.50	4.21	10.17	4.14
4th	Jan. 27–Feb. 6........10....	105.5	178.0	282.	46.0	2.29	3.87	53.06	105.5	221.38	284.¼	56.25	1.88	3.94	60.96
5th	Feb. 6–16.............10....	117.0	182.¼	318.½	36.5	3.21	4.99	25.48	117.0	228.0	322.¼	37.75	3.10	6.04	21.61
6th	Feb. 16–26............10....	128.25	180.0	......	....	3.70	4.98	17.17	128.25	225 0	333.½	11.25	11.40	20.00	......
7th	Feb. 26–March 10....12....	165.75	216.0	398.	79.5				165.75	257.12	376.	42.50	3.90	6.05	17.54
8th	March 10–20..........10....	140.0	150.0	412.	14 0	10.00	10.71	0.00	140.0	....	384.	8.00	17.50	......	......
9th	March 20–30..........10....	152.0	150.0	444.	32.0	4.75	4.69	0.00	120.37	....	396.½	12.50	9.63	......	......
	Totals and average of above	1050.	1522.	......	......	3.51	5.10	19.78	1018.4	....	......	......	2 78	5.72	28.62
	Totals and average of first seven periods...........	755.75	1222.	398.	252.75	3.00	4.83	30.02	758.0	1475.5	......	......	3.	......	....
10th	March 31–April 6..... 7....	74.75	122.0	447.0	3.0	24.92	40.67	......	90.75	210.0	430.0	33.5	2.71	6.27	20.71
11th	April 7–16............10....	136.00	180.0	467.5	20.5	4.93	8.78	......	136.0	300.	471.0	41.0	3.32	7.32	16.13
12th	April 17–26..........10....	89.56	180.0	471.5	4.0	22.39	45.00	......	116.38	300.	481.	10.0	11.64	30.00	......

SUMMARY OF RECORD OF MILK AND BUTTER PRODUCTION OF STATION HERD 1895 AND 1896.

During this year we believe epizootic abortion was driven out completely from the herd. The calves were born at regular time, with two or three exceptions, and the notable one for a period of 248 days gestation was raised. The cows were in no condition to give large yields in 1895 after holding over so long from the abortions of 1894, but coming in fresh in the fall and early winter were prepared for a good record in 1896. This record follows that for 1895 in this report. Beside the cows, records of which are given below, there were two others milked for one and a half and six months. One of these was an old imported Holstein Friesian cow which lost one-half her udder and was turned into beef. The other was a polled cow milked here for the owner until she could be sold. In this year's record the cow called Polly B. in last Biennial Report, having been registered, is given her registered name, Polly K., No. 115377, A. J. C. C.

Cow No. 2.—Grade Jersey, was dry nearly three months in midsummer. Came in fresh September 15th with grade Holstein Friesian male calf.

Cow No. 5.—Grade Jersey. This cow did not dry off, but milked the whole year and brought a cow calf by Jersey King, No. 2, on November 19th. This calf weighed only thirty-four pounds, and was born five weeks too soon. Raised it as Jersey King's No. 5.

Cow No. 7.—Came fresh September 1st, after being dry but one month. Cow calf by Polled Angus, sire. Raised as Angus' No. 7.

Spot.—This cow was sick in winter and passed gravel, which trouble yielded to treatment, but she did not recover her normal flow of milk. No calf this year, and cow dried off last of December to come in early in January, 1896. Spot came in fresh early in December, 1893, and was nearly dry when she freshened by abortion in September, 1894, and only dried off for about two weeks at the end of 1895, to begin 1896 fresh. This made 1895 an "off" year with Spot.

Daisy E.—Was dry in August, 1894, when she freshened with abortion and milked until middle of September, 1895. She came in fresh with cow calf Christmas Day, 1895. Calf was sired by Jersey King, No. 2, and is known as Jersey King's Daisy E. Daisy E. came from southwest Virginia near Fancy Gap, and is evidently a Shorthorn. This cow was purchased in May, hence while the milk and butter record covers the year, the record of her food was not begun until she came to the Experiment Farm. Hence no comparison can be made. This cow made a considerable loss during 1895 because of the abortion in 1894 and low yield until dried off.

Trixy's Rioter.—Came in with first calf early in January, 1894, and was afflicted with abortion in September of that year. She was bred to freshen again in January, 1896, but was crowded by other cows and brought a dead calf a month earlier. She did not dry off in 1895 because of the accident. She would have been dry one month under normal conditions.

Polly K.—This registered Jersey cow is a half sister to Trixy's Rioter, both having been sired by Thornbrook's Rioter, No. 16592, A. J. C. C. This one came in with cow calf a month later than Trixy's Rioter in 1894. Both had fine cow calves, and both were lost as reported,* while Polly 2d seemed to have had inflammation of the stomach. Polly K. was very small, and when her half sister was bred again she was held back to grow more, so she only brought her second calf in December of this year, another cow calf which is being raised as Polly K. 3d. By going so long in milk after first calf, some three months longer than was intentional, Polly's record for 1895 is not so favorable as it might have been. She grew by the delay from very small to nearly medium size.

Cow No. 18.—This cow went dry over three months and came fresh in August, 1895, with one of the two premature calves, a male, which was raised.

Cow No. 19.—This cow was dry nearly four months and came fresh in fine condition, but retained afterbirth and appeared to have blood poisoning. She finally recovered, but the promise of a profitable year's record was gone.

Fannie of Sedgefield.—This cow became afflicted with actinomyrosis and was not bred. She was treated with iodide of potassium, one drachm daily, until outer skin peeled off. She was considered cured, but the thickening in her throat did not leave, and her breathing was left permanently laborious thereby. Fannie made a two months' record in 1894 which has been reported with that year's record. †

Hayward's No. 6.—Came in with first calf March 28th. Raised calf as May C. Next bred to calve in fall, and gave a long period of lactation, but cow dried herself off and went dry eight months. Came in second time, September, 1896, with cow calf by Stillwater, which is being raised as Stillwater's No. 6. This heifer was a granddaughter of Cow No. 5, and her dam is reputed a good cow.

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* Bulletin No. 109, N. C. Experiment Station, page 438, for Trixy's Rioter St. Helier.

† Eighth Biennial Report 1894, page 104.

Hayward's Guernsey Jersey.—This heifer came in about same time as No. 6, milked a little better, and went dry only six months in 1896. The dry period was shortened by abortion under circumstances which indicated it to have been caused by fright. Both cows seem to have an inheritance *away from milk* from their sire, Hayward, a grade Jersey bull raised in or near this city from good stock. Hayward showed a very strong tendency to beef.*

Cow No. 20.—Received this cow on October 12, 1894. Record began the following day. She was giving only four to eight pounds of milk the first half month, but increased to over eight pounds per day for November, and over nine pounds for December. Over 9.4 pounds per day for January, 1896, and was giving four to six pounds per day early in February, when she brought a native cow calf. This cow was still milking over three and a quarter pounds per day at the end of December, 1896. Calf raised as No. 20's Native.

Dora McKee.—Was dry about six weeks in midsummer. Her 1895 record is about a normal one. Her calf previous to this one was by Sir De Bonaire, May, 1894. She was bred again in November.

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* Bulletin 93, N. C. Experiment Station, pp. 44–46.

TABLE I. FOR 1895.—*Weight of Cows, Yield of Milk, Per Cent. of Fat in Milk, Butter Fat from Monthly Tests, Calculated Yields of Butter at 85 Per Cent. and 80 Per Cent. Fat, Value of Food Consumed by Each Cow, Showing Gain +, or Loss —, Made by Each Cow During the Year or Time she was at the Experiment Farm.*

	No. 2.	No. 5.	No. 7.	No. 18.	No. 19.	No. 20.	Spot.	Dora McKee	Daisy E.	Trixy's Rioter.	Polly K. 115377 A.J.C.C	Fannie of Sedgefield.	Haywood's	
													No. 6.	Guernsey-Jersey.
Least weight for year... Month.......	Sept.	Mar.	Aug. & Sept.	Oct.	Aug.	Oct.	Mar.	Sept.	May.	July.	April.	May.	April.	April.
Least weight for year... Wt. in lbs...	895.	848.	1003.	783.	638.	645.	754.	756.	1070.	737.	550.	546. ½	637.	690.
Greatest Wt. Month.......	June.	Oct.	Mar. & Apr.	April.	June.	Dec.	Dec.	June.	Sept.	Oct. & Nov.	Oct.	Dec.	Dec.	Dec.
Greatest Wt. Wt. in lbs..	1060.	1004.	1095.	920.	927.	732.	1015.	914.	1210.	823.	741.	673.	825.	916. ½
Average weight...........	986.	903.	1048.	862.	826.	694.	899.	832.	1168.	773.	635. ½	612.	699.	790.
Yield of milk (pounds)....	3196 7	6907.5	3741.	3352.8	1771.9	675.8	3996.4	3204.4	2335.0	1627.8	2668.6	3297.8	1886.7	2228.5
Av. pr. ct. of fat in milk...	5.07	4.03	4.37	5.97	5.44	5.11	4.80	6..42	3.59	6.08	6.51	5.22	5.79	4.76
Total butter fat from monthly tests................	148.96	271.7	172.92	195.06	88.93	29.99	203.0	203.3	92.88	100.16	172.26	177.24	109.56	115.28
Calculated yield of butter at 85 per cent. fat..........	175.25	319.62	203.43	229.49	104.62	35.28	238.84	238.95	109.62	117.84	202.78	207.81	128.99	135.62
Calculated yield of butter at 80 per cent. fat..........	186.2	339.6	206.15	243.8	111.16	37.89	253.75	254.2	116.10	125.2	215.3	221.55	136.95	144.10
Value of 85 per cent. butter at 25c................	$ 43.81	$ 79 90	$ 50.86	$ 57.37	$ 26.16	$ 9.82	$ 59.71	$ 59.74	$ 27.41	$ 29.46	$ 50.69	$ 51.95	$ 32.25	$ 33.91
Value of foods consumed by cow..................	52.91	65.91	59.08	41.35	32.44	12.08	52.49	51.90	....	42.99	45.62	51.95	46.46	46.22
Difference—Gain + ...	....	+13.99	....	+16.02	....	....	+7.22	+7.84	....	....	+5.07	0.00	....	....
Loss —	—9.10	....	—8.22	....	—6.28	—2.26	....	....	....	—13.53	....	....	—14.21	—12.31

NOTES ON RECORDS OF COWS FOR 1896.

Cow No. 2.—This was the best record made by this cow. She was bred twice, and each time aborted with a very small fœtus. She became fat, and has been sent to butcher since completion of 1896 record.

Cow No. 5.—The record of No. 5 is not as good as in 1895, though it has a satisfactory balance on the right side. Instead of the calf we have been wont to get from this cow, an abortion resulted from violent exercise. Bred again to Jersey King No. 2.

Cow No. 7.—A small balance is seen in the table of records against No. 7. It is less than last year, owing to reduction of prices in part, but mainly to gain of thirty pounds of butter over last year. This cow freshened in August during the very hot weather and never seemed to yield as much as usual for her. This may be partly due to not having had the usual rest, as she only was dry about ten days. No. 7 has two cow calves in the herd, and is now in calf to Jersey King No. 2.

Cow No. 18.—A good record in 1896. This cow has no calves here which are to come under test, and she has been discarded to make room for those growing up. She went with Dora McKee December 23d.

Cow No. 19.—This cow was sold early in September. She did not breed after recovering from the trouble in 1895, and has done nothing since.

Cow No. 20.—See back. Notes are for 1895 and 1896.

Spot.—A bull calf from Spot early in January was sent to Capt. J. C. Camp, Green River, Polk County, N. C. She was bred to come in again in December, and brought another bull calf, which was sent to Mr. O. W. Sutton, Mt. Olive, Duplin County, N. C. Thus Spot has brought two calves during 1896. She became lame in one hind foot in November, caused perhaps by habit of standing in gutter wherein kainit had been used to prevent loss of ammonia. This lameness has dragged along into 1897. It seriously affects the yield from Spot for both years. However, this 1896 record by Spot is her best, as it is the highest yield of milk and of butter made by any cow in the Experiment Farm herd. The two calves although both grades are by strongly bred sires. Capt. Camp's calf was by Jersey King No. 2, owned by the N. C. Asylum for the Insane, while Mr. Sutton's calf is a grade Shorthorn by Stillwater, a dairy-bred bull from the Spencer herd of Chautauqua County, New York.

Dora McKee.—Dora was apparently crowded by strong cows, and aborted in May. She did not dry off during the year. Increasing lameness from the old broken leg made it desirable to finally dispose of her, and she was sent to the butcher December 23d, 1896.

Daisy E.—This cow was dry about six weeks, September and October, and began to milk well, but became lame about the same time Spot did, and from the same cause. This seriously reduced her yield the last part of the year and greatly damages that of 1897. In January, 1896, Daisy's yield of milk was 1,000.95 pounds of weighed milk, the largest monthly record yet made in this herd. The butter yield for that month was but 37.7 pounds as against her November record of 47.5 pounds from 961.8 pounds of milk containing a higher per cent. of fat. The check in yield of milk and butter turned the balance for this year's record to a slight loss.

Lady Victoria Pogis (A. J. C. C. No. 46573).—This cow had been dry a long time when received at Experiment Farm, and has so far failed to breed here. In order to bring the influence of lactation to bear on her as an aid to efforts at breeding her, she was regularly milked after about the middle of May, 1896. Before May was out Lady Victoria was yielding about two quarts of milk daily, and since that month has averaged over a gallon per day, butter from which more than pays for her keeping. Thus the loss shown in her column of the record for 1896 is the excess of cost of food for the full year over the value of butter from June to December inclusive. Since June 1st she has paid one-fourth more than the cost of each month's feed, and there is still a hope that she may breed again.

Trixy's Rioter.—Trixy was dry about one month and brought a cow calf. This calf had some malformation of the cervical vertebræ which caused its head to slip round to its side. The movement back and forth doubtless injured the spinal cord, and calf lived but a few days. This cow has been a constant loss, and when she came in this time, under normal conditions, yielded at most two gallons of milk and a little under one pound of butter per day. She is in contrast with her smaller half-sister, Polly K. This comparison may show the difference of inheritance from a poor and a good dam.

Polly K (A. J. C. C. 115377).—This cow was dry about five weeks. She came in in good condition, but her udder caked some and finally resulted in loss of one-quarter of the udder. Polly was sold to Prof. McCarthy and taken from Experiment Farm December 10th. Her record to date of departure was 4,650.2 pounds of milk and 297.3 pounds of butter. If the year had been completed at the same rate as for nine and a half days in December, the yield would have been 4,959.8 pounds of milk and 317.86 pounds of butter.

Fannie of Sedgefield.—Fannie went dry less than two weeks in August. She started her record in this period with a low yield, as did every cow that began a new period of lactation during or soon after the very hot weather of 1896.

Deborah.—This is a daughter of Dora McKee. She is a full Jersey, but not registered. Deborah was two years old in May, and brought her first calf August 17th. Hence her milk record covers but a few days over four months, while she has been charged for the full year's feed, and thus appears a balance of $15.86 against her. This is less than $1.33⅓ per month, and will be turned the other way if no accidents happen to this promising heifer.

Hayward's No. 6.—Dried off by middle of January and went dry *eight months.* Freshened in September and yielded a small amount of milk for less than four months, which marks this cow for her proper province—to make beef.

Hayward's G. Jersey.—This cow did somewhat better than No. 6, but has fallen far below what might have been expected. She is a better beef than dairy cow.

Substitute.—This is a family cow, not milked on Experiment Farm, but her 1896 record becomes of interest here because her calf has been raised to go into the young herd, and also from the fact that she is an Ashe County Shorthorn cow, and the calf is of the same breed. This cow came to Raleigh in a carload of beeves, but brought a calf about the first of April, 1896. She began to be milked April 9th, and in eight and two-thirds months yielded 5,588.5 pounds of milk, which, according to monthly tests, contained 333 pounds of butter, counting a full month for butter yield for April. The average per cent. of fat in milk was 4.935. In ten months the yield from this cow was, milk, 6,050.4 pounds. For butter, adding January, 1897, to nine months of 1896, gives 359.24 pounds.

The record made by Substitute in ten months exceeds that of every cow in this herd, except Spot, for milk and butter, and Daisy E, and No. 5 for milk.

From the above notes and the tables showing condensed record of the cows on the Experiment Farm, it will appear plain to every reader that there are some cows in this herd *that do not pay for their food.* This has been apparent for some time, but some have not been culled out before the end of this year's record in order to give time, after the trouble from epizootic abortion was over, for cows to resume a normal flow of milk, thus avoiding hasty judgment and consequently erroneous work. A strong example in this line of feeding at cost should set farmers to thinking, and weighing feed and milk, and to using the Babcock Tester in earnest.

Among the cows finally disposed of, No. 2 was found to have passed her usefulness as a breeder, hence in her fat condition as beef she has served the best purpose she could have been put to.

TABLE II., 1896.—*Weight of Cows, Yield of Milk, Per Cent. of Fat in Milk, Butter Fat from Monthly Tests, Calculated Yield of Butter at 85 and 80 Per Cent. Fat, Value of Butter per Cow, and Value of Food Consumed by Each Cow, Showing Gain +, or Loss —, Made by Each Cow During the Year or Time she was at the Experiment Farm.*

	No. 2.	No. 5.	No. 7.	No. 18. 2	No. 19. 1	No. 20.	Spot.	Dora McKee	Daisy E.	Lady Victoria Pogis.	Trixy's Rioter.	Polly K.	Fannie of Sedgefield.	Deborah.	Hayward's	
															No. 6.	Guernsey-Jersey.
Least Weight for year — Month	Jan.	Dec.	Aug.	Jan.	Jan.	Mar.	Dec.	May.	Dec.	May.	Nov.	Oct.	Sept.	Dec.	Sept.	July.
Wt. in lbs.	931.	831.	1031.	865.	828.	729.	801.	755.	908.	827.	763.	675.	680.	894.	788.	878.
Greatest Wt. for year — Month	Nov.	Aug.	June.	Nov.	May.	Dec.	Oct.	Feb.	Aug	Dec.	Oct.	Jan.	June.	Jan.	Aug.	Dec.
Wt in lbs.	1039.	981.	1118.	941.	879.	869.	1055.	813.	1229.	967.	861.	765.	783.	732.	877.	1027.
Average weight for year	982.5	916.	1077.	897.	841.	788.	920.	792.	1120.	900.	828.	723.	734.	817.	855.	967.
Yield of Milk, 2 1-6 lbs. 1 quart, 8⅔ lbs. 1 gallon (pounds)	5292.2	6714.7	4478.7	3845.3	1848.9	4358.	7464.	3483.	6750.3	2151.6	2581.4	4650.2	3658.9	1516.7	1400	2117.4
Average per cent. of fat in milk	4.82	4.04	4.57	6.285	4.99	5.36	4.37	6.36	3.86	4.93	5.50	5.56	5.21	6.725	5.49	5.02
Total butter fat from monthly tests	260.83	247.37	198.85	230.22	92.53	211.15	337.38	229.37	252.0	105.94	139.68	252.72	171.17	97.04	80.61	103.25
Calculated yield of butter at 85 per cent. fat	306.86	291.03	233.97	270.85	108.86	248.42	396.93	269.84	296.46	124.56	164.33	297.31	201.37	114.17	94.82	121.47
Calculated yield of butter at 80 per cent. fat	326.04	309.21	248.56	287.77	115.66	263.94	421.72	286.71	315.0	132.42	174.6	315.9	213.96	121.3	100.76	129.06
Value of 85 per cent. butter at 25c. per pound	$ 76.71	$ 72.76	$ 58.49	$ 67.71	$ 27.21	$ 62.10	$ 99.23	$ 67.46	$ 74.11	$ 31.14	$ 41.08	$ 74.33	$ 50.34	$ 28.54	$23.70	$30.37
Value of food consumed by cows	64.07	61.17	60.99	55.99	31.67	54.76	59.87	58.77	75.03	43.03	52.16	52.57	45.82	44.40	30.01	36.61
Difference—net gain +	+12.64	+11.59	....	+11.72	....	+7.34	+39.36	+8.69	....	....	....	+21.76	+4.52	....	....	....
Difference—net loss —	....	....	—2.50	....	—4.46	....	....	....	—0.92	—11.89	—11.08	....	.....	—15.86	—6.31	—6.24

1 Sold September 1. 2 Sold December 23.

Dora McKee had infirmities coming on, and Nos. 18 and 19 had passed out of usefulness as dairy cows, both having failed to breed, and, as grade cows, not being worth enough to warrant spending further efforts on them.

Trixy's Rioter has never paid, but will be retained until milked out this time, or sold on her merit.

The Hayward heifers would be good cows to enter a beef raiser's herd. They are easy keepers and are easily fattened. They should have gone into a herd for that purpose rather than into beef direct, in view of scarcity of good cows for the production of beef. Where feed is cheap, far from the city, they could pay for keep.

Fannie of Sedgefield may be dropped for non-breeding this year.

Polly K. came to this herd for two years and has proved a profitable member. She went to a new owner in December.

There will be coming into service in the fall and winter of 1897–98 a number of heifers from cows No. 5, No. 7, Daisy E., Polly K., No. 20 and Substitute. A daughter of No. 6 began in milk at the end of December last, but may not be retained.

There are cow calves from the 1896 produce of No. 6, Daisy E. and No. 7, by Stillwater, to be raised.

In all probability there is not a herd of cows in the hands of any one of the readers of these notes but that has some one or more members which it would be betrer to cull out if the right cow were known. These are the ones termed "robber cows" by writers, the ones which cost more than they produce. This standard of cost will vary much with location and market. The standard for production should rest on yield of milk and butter fat.

About 200 pounds would be a good standard to start with, and below which to discard individuals. The amount of food consumed by cows and the use made of it are also two points of great importance to be taken into consideration. It is regretted that the small area of Experiment Farm has prevented our raising sufficient clover and pea-vine hay to nearly balance rations, instead of having been obliged to use wheat bran and cotton seed and other meals so freely. This would have turned the purchase-money for foods much more toward the pocket of the home farm, and would have made the cows the honored purchasers and consumers of more home produce than they have been able to use.

With these few remarks, and suggesting the use of scales to determine the food actually consumed, as well as to indicate the returns in products made by each cow, and the Babcock Tester for fat, we turn to show the amount of food consumed by the cows in making the above records.

Foods Consumed by Cows 1895.

The chief foods used to feed cows were corn silage for January, part of February, May, June, September, October, November and

December, with wheat bran and cotton-seed meal. Wheat bran and cotton-seed meal have usually been fed in the ratio of two to one by weight, and from three to five pounds of silage is fed for every pound of the mixed meal.

For part of February, March and April the same meal feed was given with silage made from corn and soy beans grown in alternate "hills." The beans suffered from shading of corns and were not as prominent in the ration as we had desired. In May some prickly comfrey was fed, in July and August cowpea-vine silage, and following it a siloge made of freshly-cut corn, mixed with crimson clover straw and chaff, with water enough used to moisten the dry articles and bring them into fermentation. In September and October green corn was fed to some extent. Crimson clover hay was fed in November and December. To some cows linseed-oil meal and cowpea meal were fed. The cows were thus fed in barn for the full year. They were tied in stanchions to feed, and often stayed there during the day, to be turned loose in a large yard with access to water during the night. Whether tied up in the stanchions or turned loose, the comfort of the cows has been considered, as the yields of milk and butter are dependent on that portion of the food which is left from supporting the cow, and supplying whatever is used in the system to overcome discomfort, or rather wasted by discomfort and excitement.

In 1896 there may have been a somewhat wider range of foods. Cotton-seed meal was fed every month to nearly every cow. One cow, Daisy E., has been seriously affected by cotton-seed meal previous to her purchase by the Experiment Station, and for her linseed-oil meal or cowpea meal was mainly used instead of cotton-seed meal. Wheat bran was superseded by corn bran in June, July, August and September, after which the price of wheat bran dropped so low that it was again fed. Corn silage was the principal coarse food until May, and from October to the end of the year both months included. In June rye hay and cotton-seed hulls, with hulls and cowpea vines for July, whilst green corn and cowpea vines in August were the principal coarse feeds. This may seem rather out of place to feed the coarse dry foods in midsummer, but it is during the time when the aim is to have dry cows and little product to handle. Had the farm a little greater area the cows could cut their own feed from Bermuda grass and clover pasture at this time. As it is only two cows were grazed out in 1896, and for three months one of these was not fed in barn, and to the other next to nothing was fed during that time.

The prices charged and paid by cows for three years, with net results each year and the average result for each cow, is given in Table III. No credit is given any of them for calves. During the first of the three years few calves could have been raised, and

TABLE III.—*Prices Paid, by Cows, for Food, 1894–5–6; also Net Results, by Several Cows, in those Years.*

NAME OF ARTICLE.	Price Paid in 1894.	Price Paid in 1895.	Price Paid in 1896.	NAMES OF COWS.	Profit+ Loss — 1894. $	Profit+ Loss — 1895. $	Profit+ Loss — 1896. $	Average Result. $
Coarse Foods.								
Green grass, green rye, green corn or peavines; also waste when re-fed	$ 4.00	$ 4.00	$ 4.00					
Corn silage or waste silage when re-fed	5.00	5 00	5.00	No. 2	+ 8.02	— 9.10	+12.64	+ 3.85
Soy bean, cowpea vine, or C. clover, straw and corn silage	7.50	7.50		No 5	— 0.36	+13.99	+11.59	+ 8.41
Partly cured corn and re-fed waste		7.50		No. 7	+ 4.07	— 8.22	— 2.50	— 2.22
Prickley comfrey	4 00	4 00	4 00	Spot	+23 03	+ 7.22	+39.36	+23.20
Corn stubble		2.00	4 00					
Cotton-seed hulls	4.00	4.00	4 00	Dora McKee	+ 8 59	+ 7.84	+ 8.69	+ 8.37
Corn shucks		9 00	9.00-7.00					
Blade fodder, crimson-clover hay				Trixy's Rioter	— 6.34	—13.53	—11.09	—10.32
Sheaf oats, peavine hay and re-fed waste from these	15.00	15.00	15.00	No. 18	+17.88	+16.02	+11.72	+15.21
Wheat straw		8.00						
Cotton seed	13.33⅓	13.33⅓	13.33⅓	No. 19	+19 90	— 6.28	— 4.46	+ 3.05
Rye hay, oats in straw			10 00	Polly K.	+ 8.25	+ 5.07	+21.76	+11.69
Fine Foods.								
Cotton-seed meal	20 00	18.00	20.00	Daisy E.		+ 0.49	— 0.91	— 0.21
Wheat bran	20.00	20.00	16.00	Fannie of Sedgefield.		+18 18	+ 4.52	+11 35
Cowpea meal	25.00	15.00	25.00	Haywood's No. 6		—14.21	— 6.31	—10.26
Corn meal	25 00	25.00	20 00	Haywood's G.-Jersey		—12.31	— 6.23	— 9.27
Linseed meal	27.00	30.00	22.50	No. 20			+ 7.34	+ 7.34
Wheat meal		15.00						
Oats, ground		35 00						
Oats			22.00					
Corn bran			10.00					

Extremes—Spot gains $23.20 per year; Trixy's Rioter loses $10.32 per year.

every year some are undesirable, and if vealed the milk consumed would be worth more than the calf. Hence no account has been made of them in this statement. If credit were given for cow calves raised, two, No. 7 and Daisy E., would be carried to the positive side for the good calf each year.

The only discussion of prices or results desirable here is to call the attention of farmers to a point often overlooked by them. The crops are sold *at home* to customers who never beat about the bush or cheat, but pay according to what they get and the treatment accorded them, if we farmers do our duty in selection and care.

EXPERIMENT FARM BARN WELL-SUITED FOR ANIMAL COMFORTS.

This barn* has a large shed attached to it on the west, quite open, yet which can be closed up in cold weather, and has been surrounded with a fence so the cows have a narrow yard all around the barn. Thus they can lie in the shade within, or on the north side, or in winter and spring in their favorite places on the south side, when given freedom to select for themselves. At other times they are confined on platforms which allow each cow about as much standing or lying room as she needs for comfort, and the doors are closed in cold, or thrown open in warm weather. To a great extent the extreme ranges of heat are thus tempered, so that when outside it may be either uncomfortably cold or hot, within the barn it is usually very comfortable. This may be inferred from the following record of a Draper's Self-Recording Thermometer. This thermometer was installed in a central location in the main barn in January, 1894, and remained there in constant use nearly three years. Part of the record was given in Bulletin 118. This record, which was made by this thermometer for 1895 and 1896, has been condensed to the following record: The range of temperature in the main barn is a little less than in the large shed, which is not so tight when closed, and which is open to the roof, and consequently is both somewhat cooler and warmer than is the barn. The daily records are averages of twenty-four hourly readings taken from the record made by the instrument each day.

The temperaure averaged below freezing one day in January and eight days in February, 1895. In 1896 there were three days in January and four days in February when the temperature averaged below freezing. The standard maximum and minimum thermometers in the Experiment Farm thermometer shelter registered during some of these months as follows:

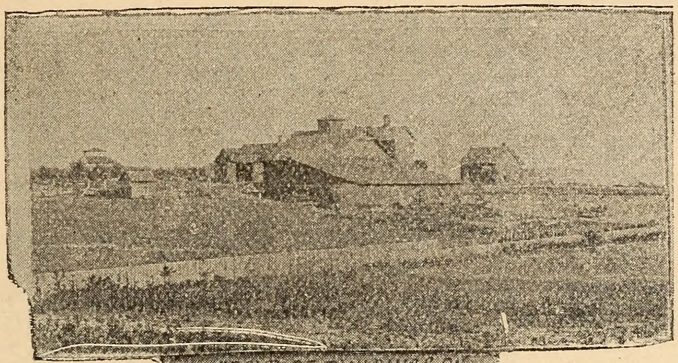
In January, 1895, one day, when the maximum remained below freezing, and the minimum rose to above freezing on sixteen days. In February the maximum remained at or below freezing during nine days, whilst there were only four days on which the minimum registered at or above freezing.

In 1896 the maximum remained below freezing during three days, and the minimum remained above freezing fourteen days in January. With rather a broken record in February, the maximum record showing only one whole day below freezing, whilst the minimum recorded above freezing on fourteen days.

---

*See cuts Bulletin No. 68, N. C. Experiment Station, pp. 99 and 100, and cut herewith.

The records show just what would naturally be expected ; much the wider range of temperature in the thermometer shelter as compared with the stable, but when comparisons are made of the mean monthly temperatures the greater range is found to have averaged much nearer the average stable record than might have been expected. The stable averages warmer for the winter half of the year and cooler during the summer half, but the protection from sun, wind and rain is not even hinted at in these average records of temperature. The minimum record conveys some idea of discomfort. Add to these cold days other times when, in the language of the street, "it has turned cold," which is indicated by a cold, icy draft from the north, and the drizzling rainy days, with temperature at or near freezing, and comfortable shelter is warranted and needed in this part of North Carolina.



GROUP OF BUILDINGS ON THE EXPERIMENT FARM

TABLE IV.—*Stable Temperature Record, Compared with that of Standard Thermometer Shelter.*

YEAR AND MONTH.	Draper Constant Recording Thermometer.			Standard Maximum and Minimum Thermometers.				
	Stable Record.			Standard Thermometer Shelter.				
	Highest Average Daily Temperature.	Lowest Average Daily Temperature.	Av. or Mean Monthly Temperature.	Highest Average Daily Temperature.	Lowest Average Daily Temperature.	Mean or Average Monthly Temperature.	Maximum Temperature for Month.	Minimum Temperature for Month.
1895	F.°	F.°	F.°	°F.	°F.			
January	57.2	25.0	43.0	57.0	17.0	39.2	67.0	7.0
Februry	56.0	17.0	36.9	58.0	10.0	32.1	69.0	3.0
March	63.0	39.6	51.4	67.0	36.0	49.3	82.0	25.0
April	67.0	46.0	58.6	70.0	44.0	57.8	82.0	33.0
May	81.0	53.0	64.3	85.0	52.0	65.8	98.0	41.0
June	82.0	64.7	73.0	88.0	66.0	76.8	100.0	53.0
July	78.2	67.0	68.9	84.0	68.0	76.2	96.0	60.0
August	80.0	69.2	75.5	84.0	67.0	78.2	94.0	60.0
September	81.3	58.1	74.2	86.0	57.0	75.8	98.0	50.0
October	66.7	48.3	58.1	68.0	45.0	57.0	80.0	34.0
November	70.3	42.7	54.2	72.0	36.0	51.0	77.0	26.0
December	61.6	34.0	46.5	64.0	24.0	44.2	68.0	25.0
Mean for the year,			58.7			58.6		
1896								
January	53.7	25.1	42.4	52.0	18.0	39.0	65.0	12.0
February	58.0	26.5	45.4	60.5	19.3	43.9	69.0	7.5
March	68.4	39.8	52.5	69.3	33.5	48.0	75.0	23.0
April	78.0	48.0	60.5	80.0	42.0	68.1	92.0†	31.0
May	88.0	60.1	74.3	83.2	59.8	74.3	94.5	47.0
June	80.4	67.0	74.0	82.5	63.5	79.4	92.0	58.0
July	78.8	85.4	68.9	88.1	67.7	80.1	98.3	63.0
August	85.2	68.8	78.6	86.0	67.0	78.6	98.5	56.0
September	82.2	58.3	72.6	80.5	56.5	72.6	98.0	45.0
October	69.8	53.7	60.6	68.3	51.0	57.3	76.5	37.5
November	69.6	43.7	59.6	65.8	33.3	53.6	77.5	29.0
December*	57.1	33.0	48.5	57.0	25.0	41.2	64.0	16.0
Mean for the year,			61.5			61.3		

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* No record after 15th, as instrument was loaned to Station Laboratory.

Ornithology of North Carolina.

A List of the Birds of North Carolina, with Notes of Each Species.

ISSUED BY
THE NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION
RALEIGH, N. C.

BULLETIN No. 144

OCTOBER 30, 1897

Publications will be sent to any address in North Carolina upon application.

NORTH CAROLINA COLLEGE OF AGRICULTURE AND MECHANIC ARTS,

RALEIGH, N. C.

THE NORTH CAROLINA

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The Director's office is in the main building of the College. Telephone No. 135 C. The street cars pass within one hundred yards of the College building. The Station is glad to receive any inquiries on agricultural subjects. *Address all communications to the Agricultural Experiment Station, and not to individuals.* They will be referred to the members of the Station staff most competent to answer them.

The accompanying bulletin is the first of its kind issued by this Experiment Station. It is not, however, the first publication of its kind, as the author shows in his preface. It is believed, to be the most complete list of the Birds of the State that has been published.

The list is the result of many hours of labor taken from his regular work or time of recreation, and is a donation by the author to the Experiment Station. While the work seems to have been done with care, yet it is possible that some species have been omitted. The Experiment Station or the author will be grateful for the mention of any omissions.

It is hoped that this bulletin will cause an additional interest to be awakened in birds, about which far too little is known.

W. A. WITHERS,
Acting Director.

Publication approved:
ALEX. Q. HOLLADAY,
President.

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PREFACE.

In contemplation of this list I have spared no pains in gathering material from all available sources, which I have boiled down and condensed, and am glad to present it in as complete form as is possible at this date.

HISTORICAL.—Catesby's work, in 1670, was the first to appear on the birds of this State, but this work included a great deal more territory than North Carolina, and did not embrace one-half of the birds now known to occur within our borders. Then followed the publication of several minor papers, at irregular intervals, devoted principally to the ornithology of the various sections, when, in 1887, Prof. G. F. Atkinson, of the University of North Carolina, published a list of all the birds then known to him to occur within the bounds of the State. Incomplete though this list was, it has served a good purpose—that of a stimulus; and since that time much work has been done by a few zealous workers. Many new species have been added, and new and more complete notes taken on nearly all the species recorded by him; their general distribution and nesting habits have been more fully studied and carefully observed; the result of which is given forth in this list. It is an entirely new list, so far as the annotations are concerned, in nearly every respect.

GEOGRAPHICAL AND PHYSICAL CHARACTERISTICS OF THE STATE.—North Carolina is peculiarly situated, geographically, and divided, physically; so that it presents a variety of climate, and consequently a varied bird-life, which is exceedingly interesting. Midway, as it were, between the North and South, and reaching from the Atlantic ocean westward five hundred miles to the heights of the Alleghanies, we are visited by nearly all the migrants of eastern North America. Physically, it is divided into three distinct regions, viz., the eastern or tide-water, which can roughly be said to include all the land east of a line which indicates an altitude of one hundred feet above the sea-level; the middle or piedmont, which is bounded by the above-described line on the east, and a similar one on the west, indicating the altitude of five hundred feet; and the western or mountain section, which includes all the territory west of the piedmont section, embracing all the mountains of the State to the eastern boundary of Tennessee. From the sea-level in the east the altitude gradually increases till a height of more than six thousand feet is reached in the west. These variations in climate and physical characteristics give us, in a great degree, our varied bird-life. In the higher mountains ours somewhat resemble the Canadian *avian fauna*, inasmuch as many birds are found breeding there which usually make a more Northern place their summer home. In the east the climate is mild and equable, being tempered by the Gulf Stream, and many birds winter there, and occasionally that section has stragglers which it would not were it not for its peculiar situation and environment.

SCOPE OF THE WORK.—Three hundred and three species are listed, which includes all that are known to occur within the borders of the State at the present time. Two species are recorded upon evidence that they once occurred and they may be found again. An Appendix of twenty-two species is added, of species which ought to occur, and we may expect to take them if we are careful.

SOURCE OF MATERIAL.—During the past ten years I have devoted much time to the study of the ornithology of our State, and the result of all my study and observations is embodied in and constitutes the foundation of this work. To the following gentlemen I am also greatly indebted, for without their assistance this list could never have been as complete as I am now able to make it:

Mr. H. H. Brimley, Curator State Museum, Raleigh, N. C., for notes on the ducks and a few water-birds found on our sounds in winter, and for notes on the specimens received at the Museum.

Mr. C. S. Brimley, Raleigh, N. C., for a list of the birds of the vicinity of Raleigh, and all the notes he has collected through several years collecting and corresponding in various portions of the State.

Mr. John S. Cairns, a short time before his untimely death, sent me a complete list of the birds of Buncombe County, which has been of much service to me. In the death of this ardent lover of nature we have lost one of our brightest stars, and, I fear, his place will long remain vacant. His home was in Weaverville, among the giants of nature.

Mr. Joe H. Armfield, Greensboro, N. C., sent me a list of all the birds which had come under his observation through several years collecting, which contained some interesting and valuable notes on the nidification habits of some of the rarer species.

Mr. T. Gilbert Pearson, Curator Guilford College Museum, Guilford College, N. C., has rendered assistance by sending a list of all the birds he has identified during his residence in North Carolina. His former home was in Florida.

Mr. R. P. Smithwick sent me a list of the birds of Bertie County, with notes on each species, which has proven of service.

Mr. C. J. Maynard, Newtonville, Mass., furnished some valuable notes on a few species of our coast birds, observed by himself in 1876.

Mr. H. Gould Welborne, Lexington, N. C., sent some interesting notes on the species he has observed in his immediate section.

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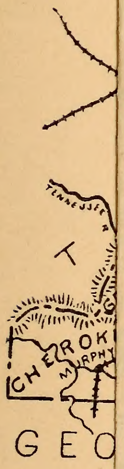

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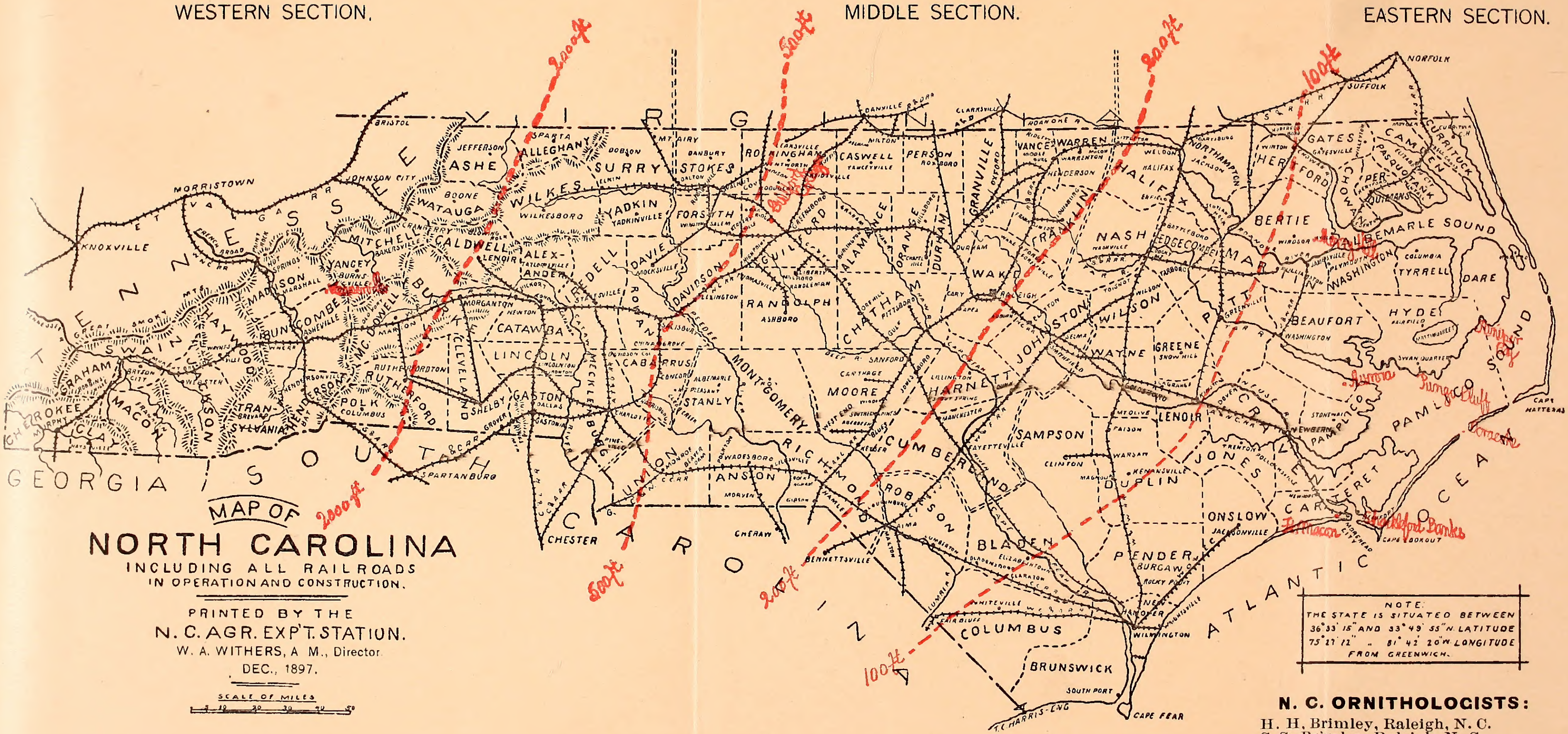

MAP OF
NORTH CAROLINA
INCLUDING ALL RAILROADS
IN OPERATION AND CONSTRUCTION.

PRINTED BY THE
N. C. AGR. EXP'T. STATION.
W. A. WITHERS, A. M., Director.
DEC., 1897.

N. C. ORNITHOLOGISTS:

H. H. Brimley, Raleigh, N. C.
C. S. Brimley, Raleigh, N. C.
H. G. Welborne. Lexington, N. C.
Joe H. Armfield, Greensboro, N. C.
R. P. Smithwick, Merry Hill, N. C.
T. G. Pearson, Guilford College, N. C.
Dr. J. W. P. Smithwick, Aurora, N. C.

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J. W. P. SMITHWICK, M. D.

Aurora, N. C., October 26, 1897.

ANNOTATED LIST.

J. W. P. SMITHWICK, M. D., AURORA, N. C.

Family PODICIPIDÆ. Grebes.

1. HOLBŒLL'S GREBE. *Colymbus holbœllii.* (Reinh.)
Common on the coast in winter. Has been exhibited in the meat at the Newbern Fair, and often caught in the fish-nets on the Neuse river. One record for the middle section, that of Atkinson.

2. HORNED GREBE. *Colymbus auritus.* (Linn.)
Common winter visitor on the coast and adjacent waters; rare visitor in the mountains, winters of 1886–87.

3. PIED-BILLED GREBE. *Podilymbus podiceps.* (Linn.)
Frequent winter visitor in the east; rare transient in the middle and western sections.

Family URINATORIDÆ, Loons.

4. LOON. *Urinator imber.* (Gunn.)
Common in the east during the winter along the water courses; probably a rare winter visitor at Raleigh one taken winter of 1887, several winter of 1897; transient in the mountains.

5. RED-THROATED LOON. *Urinator lumme.* (Gunn.)
Common in winter on the waters of the eastern section, often caught in the fish nets on the Neuse river.

Family ALCIDÆ. Auks, Murres and Puffins.

6. BRUNNICH'S MURRE. *Uria lomvia.* (Linn.)
One specimen was procured in Newbern on December 27, 1896, by T. Gilbert Pearson. This specimen was identified by Prof. Ridgway, and is now in the Guilford College Museum.

7. RAZOR-BILLED AUK. *Alca torda.* (Linn.)
The head, wing and foot of one of this species were sent to the Department of Agriculture, Washington, D. C., for identification, by Lieut. Foley, U. S. N. It was taken at Lookout Cove, February, 1890. Others were seen.

Family LARIDÆ. Gulls and Terns.

8. AMERICAN HERRING GULL. *Larus argentatus smithsonianus.* (Coues.)
Very abundant resident along the coast in winter, staying from from September till April.

9. RING-BILLED GULL. *Larus delawarensis.* (Ord.)
Spring and fall migrant along the coast, may be a winter resident; accidental in the mountains, a pair taken by Cairns in November, 1889, near Asheville.

10. LAUGHING GULL. *Larus atricilla.* (Linn.)
Common on the coast. Given by Prof. Atkinson as breeding, and consequently a summer resident, but Dr. Coues says he never observed it breeding at Fort Macon, though they stay away only a short time during the summer, and that they must breed near by.

11. BONAPARTE'S GULL. *Larus philadelphia.* (Ord.)
Extremely abundant migrants on the coast; accidental in the middle section one taken by S. B. Moore, Franklin County, December, 1890.

12. ROYAL TERN. *Sterna maxima.* (Bodd.)
A common summer visitor on the coast, probably breeding, as Dr. Coues saw young ones still receiving attention from their parents at Fort Macon. One specimen was received at the State Museum, February, 1897.

13. CABOT'S TERN. *Sterna sandvicensis acuflavida.* (Cabot.)
Common migrant on the coast principally, but also a rare winter visitor.

14. FORSTER'S TERN. *Sterna forsteri.* (Nutt.)
This, like the above species, is a migrant, but also, sparingly a winter resident.

15. COMMON TERN. *Sterna hirundo.* (Linn.)
Common migrant along the southern part of the coast; summer visitor along Currituck Sound.

16. LEAST TERN. *Sterna antillarum.* (Less.)
Summer resident on the coast, breeding in great numbers. They arrive in April and leave in October, nesting during the latter part of May and early June.

17. SOOTY TERN. *Sterna fuliginosa.* (Gmel.)
Common migrant on the coast.

18. BLACK TERN. *Hydrochelidon nigra surinamensis.* (Gmel.)
Migrant on the coast; seems to be an irregular summer visitor about Raleigh, being observed there during the summers of 1884, 1888 and 1892.

Family RYNCHOPIDÆ. Skimmers.

19. BLACK SKIMMER. *Rynchops nigra.* (Linn.)
Common on the northern part of the coast in summer, probably breeding; migrants along the southern part of the coast.

Family PROCELLARIDÆ. Fulmars and Shearwaters.

20. Cory's Shearwater. *Puffinus borealis.* (Cory.)

Recorded by Atkinson, being identified by him from a wing of a shearwater taken at Beaufort.

21. Greater Shearwater. *Puffinus major.* (Faber.)

Maynard writes in a letter of late date, "I have just returned from a trip to the Bahamas, and on our way up, when off Cape Hatteras, some fifty miles out, I saw a number of greater shearwaters. This was July 4, 1897.

22. Sooty Shearwater. *Puffinus stricklandi.* (Ridgw.)

One specimen was taken by Dr. Coues, May 21, 1870, another was taken at Beaufort, June 8, 1892, by H. H. Brimley.

Family SULIDÆ. Gannets.

23. Gannet. *Sula bassana.* (Linn.)

Several were recorded by Dr. Coues at Fort Macon in 1869–70, being seen during the foul weather.

Family PHALACROCORACIDÆ. Cormorants.

23. Double-crested Cormorant. *Phalacrocorax dilophus.* (Sw. & Rich.)

Very common visitor on the coast in winter; one specimen taken near Asheville, November, 1887.

25. Florida Cormorant. *Phalacrocorax dilophus floridanus.* (Aud.)

Tolerably common on the coast in summer, except the very hottest months, probably breeds.

Family PELICANIDÆ. Pelicans.

26. American White Pelican. *Pelecanus arythrorhynchos.* (Gmel.)

One was taken by Brimley at Raleigh in 1884; in May, 1889, a flock of forty went up the French Broad river, five of which were taken by Cairns.

27. Brown Pelican. *Pelecanus fuscus.* (Linn.)

An irregular summer visitor on the coast.

Family ANATIDÆ. Ducks, Geese and Swans.

28. American Merganser. *Merganser americanus.* (Cass.)

Common winter visitor on the coast; tolerably spring transient in the mountains.

29. Red-breasted Merganser. *Merganser serrator.* (Linn.)

Abundant winter visitor along the water courses of the eastern section.

30. HOODED MERGANSER. *Lophodytes cucullatus.* (Linn.)
Winter visitor, common in the eastern section, rare in the middle; tolerably common spring transient in the west.

31. MALLARD DUCK. *Anas boschas.* (Linn.)
Winter visitor; common in the east, tolerably common in the middle section; not a common transient in the mountains.

32. BLACK DUCK. *Anas obscura.* (Gmel.)
Common in the east, rare in the middle section; winter visitant.

33. GADWALL. *Anas strepera.* (Linn.)
Common in the eastern section, rare in the middle; winter visitor.

34. WIDGEON. *Anas penelepe.* (Linn.)
Maynard says, "It is really a regular visitant every season, especially in the sounds of North Carolina." One was taken on the property of the Currituck Shooting Club, January, 1897.

35. BALDPATE. *Anas americana.* (Gmel.)
Common winter visitor, confined to the eastern section.

36. GREEN-WINGED TEAL. *Anas carolinensis.* (Gmel.)
Rare transient in the western and middle sections; common winter visitor in the east.

37. BLUE-WINGED TEAL. *Anas discors.* (Linn.)
Tolerably common transient in the western and middle sections; common winter visitor in the east.

38. SHOVELLER DUCK. *Sptula clypeata.* (Linn.)
Tolerably common spring transient in the mountains; common winter visitor in the east.

39. PINTAIL DUCK. *Dafila acuta.* (Linn.)
Common winter visitor on the coast.

40. WOOD DUCK. *Aix sponsa.* (Linn.)
Tolerably common resident in the eastern and middle sections; rare summer visitor in the mountains. Breeds in all sections of the State.

41. REDHEAD DUCK. *Aythya americana.* (Eyt.)
Rare transient in the mountains; rare winter visitor in the middle section; common on the coast.

42. CANVASS-BACK DUCK. *Aythya vallisneria.* (Wils.)
Very common on Currituck Sound, as observed by H. H. Brimley; Dr. Coues never saw it at Fort Macon.

43. AMERICAN SCAUP DUCK. *Aythya marila nearctia.* (Stejn.)
Tolerably common transient in the mountains; rare winter visitor in the middle section; tolerably common in the east as a winter visitor.

44. LESSER SCAUP DUCK. *Aythya affinis.* (Eyt.)
Common on the coast, rare in the central portion, winter visitor; rare transient in the mountains.

45. RING-NECK DUCK. *Aythya collaris.* (Donov.)
Rare transient in the mountains; common winter visitor on the coast.

46. AMERICAN GOLDEN-EYE. *Clangula clangula americana.* (Bonap.)
Common winter visitor on the coast; rare transient in the mountains.

47. BARROW'S GOLDEN-EYE. *Clangula islandica.* (Gmel.)
One taken by Cairns near Asheville, May 6, 1893; a specimen in the State Museum is a rare form of *C. islandica*, or an intermediate between *C. islandica* and *C. clangula americana;* a specimen was received at the State Museum which was determined to be *C. islandica*, in early part of February, 1897.

48. BUFFLE-HEAD DUCK. *Charitonnetta albeola.* (Linn.)
Winter visitor, coast, common; middle region, rare; mountains, rare transient.

49. OLD SQUAW. *Harelda hyemalis.* (Linn.)
Tolerably common winter visitor on the coast; accidental in the mountains, one taken February, 1887.

50. WHITE-WINGED SCOOTER. *Oidemia deglandi.* (Bonap.)
Tolerably common on the coast in winter.

51. SURF SCOOTER. *Oidemia perspicillata.* (Linn.)
Very common on the coast in winter.

52. RUDDY DUCK. *Erismatura jamaicensis.* (Wils.)
Common winter visitor on the coast.

53. BLUE GOOSE. *Chen cœrulescens.* (Linn.)
Accidental. One live specimen was seen in possession of S. J. Moore, Beaufort, by Atkinson, which was taken on Bogue beach one mile from Fort Macon.

54. GREATER SNOW GOOSE. *Chen hyperborea nivalis.* (Forst.)
Common on Pamlico Sound and northward in winter.

55. AMERICAN WHITE-FRONTED GOOSE. *Anser albifrons gambeli.* (Hartl.)
One taken in Buncombe County by Cairns; one taken on Currituck Sound, January, 1897.

56. CANADA GOOSE. *Branta canadensis.* (Linn.)
Tolerably common transient in the mountain and middle sections; common winter visitor all through the eastern section.

57. BRANT. *Branta bernicla.* (Linn.)
Common winter visitor on the coast.

58. BARNACLE GOOSE. *Branta leucopsis.* (Bechst.)
Dr. Allan, in "Birds of Massachusetts," says, "It has been taken in North Carolina."

59. WHISTLING SWAN. *Olor columbianus.* (Ord.)
Common on the coast and adjacent waters in winter.

Family CICONIIDÆ. Storks and Ibes.

60. WOOD IBIS. *Tantalus loculator.* (Linn.)
Accidental summer visitor in the middle section, one specimen taken so far.

Family ARDEIDÆ. Herons and Bitterns.

61. AMERICAN BITTERN. *Botaurus lentiginosus.* (Montag.)
Tolerably common transient in the mountain and middle sections; resident in the eastern section.

62. LEAST BITTERN. *Ardetta exilis.* (Gmel.)
Only two specimens reported from the mountain section; rare summer visitor in the middle section, breeding; tolerably common summer visitor in the east.

63. GREAT BLUE HERON. *Ardea herodias.* (Linn.)
Resident in all portions, perhaps rarer to the west. Breeds throughout its range.

64. AMERICAN EGRET. *Ardea egretta.* (Gmel.)
Summer visitor; rare in the middle section; tolerably common in the east.

65. SNOWY HERON. *Ardea candidissima.* (Gmel.)
One specimen taken by Cairns in the mountains; tolerably common summer resident in the eastern section.

66. LITTLE BLUE HERON. *Ardea cœrulea.* (Linn.)
Tolerably common summer resident in all portions, breeding.

67. GREEN HERON. *Ardea virescens.* (Linn.)
Common summer visitor, breeding throughout the State. Commonly called "Scouk," "Schytepoke," etc.

68. BLACK-CROWNED NIGHT HERON. *Nycticorax nycticorax nævius.* (Bodd.)
Probably a summer resident in the east, one immature bird taken and another seen at Shackleford Banks, Carteret County, by H. H. Brimley; specimens from Buncombe County are in the State Museum.

69. YELLOW-CROWNED NIGHT HERON. *Nycticorax violaceus.* (Linn.)
Atkinson reported one from Beaufort in 1887; one was exhibited in the meat at the Newbern Fair, 1892; an immature female taken at Raleigh on June 25, 1884, and a male July 15, same year.

Family RALLIDÆ. Rails, Gallinules and Coots.

70. KING RAIL, *Rallus elegans.* (Aud.)
Summer visitor in all portions; common in the east, rarer to the west. Occasionally seen in eastern and middle sections during the winter season. Breeds, probably, throughout its range. Eggs taken from the middle section are in my collection.

71. CLAPPER RAIL. *Rallus crepitans.* (Gmel.)
Common resident in the marshes of the eastern section, breeding abundantly.

72. VIRGINIA RAIL. *Rallus virginianus.* (Linn.)
Reported as a rare transient visitor in the middle section; specimens seen April, 1889, and March, 1891; common transient in the east.

73. SORA. *Porzana carolina.* (Linn.)
Tolerably common transient in the mountains; one specimen seen near Raleigh by H. H. Brimley December, 1890.

74. YELLOW RAIL. *Porzana noveboracensis.* (Gmel.)
Rare transient in the mountains; one captured alive near Raleigh by Brimley September, 1882; one observed by Dr. Coues April 12, 1871, at Fort Macon; two specimens at the Newbern Fair, 1892.

75. BLACK RAIL. *Porzana jamaicensis.* (Gmel.)
Rare summer visitor in the middle and western sections, breeding. Eggs have been taken near Asheville, Statesville and Raleigh.

76. PURPLE GALLINULE. *Ionornis martinica.* (Linn.)
Accidental summer visitor in the middle section.

77. FLORIDA GALLINULE. *Ionornis galeata.* (Licht.)
Rare spring transient in the mountains; one specimen taken by Brimley in Newbern in 1885, one by Brewster near Asheville in 1885, one by myself in Bertie County in 1890, and one in Orange County in 1892.

78. AMERICAN COOT. *Fulica americana.* (Gmel.)
Rare transient in the mountains; several taken by Brimley in the middle section; common on the coast.

Family PHALAROPODIDÆ. Phalaropes.

79. NORTHERN PHALAROPE. *Phalaropus lobatus.* (Linn.)
"Where they go for safety when those gales for which the region

about Cape Hatteras is famous, sweep over the ocean, I know not." (*Vide* "Birds of Eastern North America," Maynard).

Family RECURVIROSTRIDÆ. Avocets and Stilts.

80. AMERICAN AVOCET. *Recurvirostra americana.* (Gmel.)
Dr. Coues identified this species on the 12th of September, 1870, when a flock of six was seen at Fort Macon.

Family SCOLOPACIDÆ. Snipes, Sandpipers, etc.

81. AMERICAN WOODCOCK. *Philohela minor.* (Gmel.)
Tolerably common resident in all portions, breeding. I have taken badly-incubated eggs on the 1st of March.

82. WILSON'S SNIPE. *Gallinago delicator.* (Ord.)
Common winter resident in the eastern and middle sections; spring transient in the mountains.

83. DOWITCHER. *Macrorampus griseus.* (Gmel.)
Abundant migrant and perhaps a casual winter resident on the coast; rare summer visitor in the middle section.

84. LONG-BILLED DOWITCHER. *Macrorampus scolopaceus.* (Say.)
Recorded by Prof. Atkinson, who identified it from one specimen seen at Beaufort.

85. KNOT. *Tringa canutus.* (Linn.)
Two specimens were received at the State Museum from Carteret County, by the Curator, May 21, 1897.

86. PECTORAL SANDPIPER. *Tringa maculata.* (Veill.)
Transient visitor; common on the coast, rare in the middle section.

87. WHITE-RUMPED SANDPIPER. *Tringa fuscicollis.* (Veill.)
Common on the coast during the migrations.

88. LEAST SANDPIPER. *Tringa minutilla.* (Veill.)
Rare transient in the mountain and middle sections; very common on the coast, both spring and fall.

89. RED-BACKED SANDPIPER. *Tringa alpina pacifica.* (Coues.)
Abundant migrant on the coast, a few, probably, remaining all the winter.

90. SEMIPALMATED SANDPIPER. *Ereunetes pusillus.* (Linn.)
Very abundant on the coast during the migrations.

91. SANDERLING. *Calidris arenaria.* (Linn.)
Abundant winter resident on the coast.

92. MARBLED GODWIT. *Limosa fedoa.* (Linn.)
Common during the migrations along the coast, and probably

summers along the northern part; Maynard reports it common at Beaufort and southward, November 17, 1876.

93. GREATER YELLOW-LEGS. *Totanus melanoleucus*, (Gmel.)
Common migrant on the coast; tolerably common transient in the middle section; rare in the mountains.

94. YELLOW-LEGS. *Totanus flavipes.* (Gmel.)
Transient; rare in the mountains, tolerably common in the middle and eastern sections.

95. SOLITARY SANDPIPER. *Totanus solitarius.* (Wils.)
Transient visitor in all portions; rare in mountains; not abundant in the middle and eastern sections.

96. WILLET. *Symphemia semipalmata.* (Gmel.)
Resident on the coast, not so abundant during the colder months, breeds.

97. RUFF. *Pavoncella pugnax.* (Linn.)
Accidental in the middle section. One female taken at Raleigh on May 6, 1892, by H. H. Brimley.

98. BARTRAMIAN SANDPIPER. *Bartramia longicauda.* (Bechst.)
Tolerably common transient in the middle section.

99. SPOTTED SANDPIPER. *Actitis macularia.* (Linn.)
Common migrant and summer resident on the coast, breeding; common transient in the middle section; a few summer on the Neuse river; rare summer visitor in the mountains, but a common migrant.

100. LONG-BILLED CURLEW. *Numenius longirostris.* (Wils.)
Common resident on the coast, more common during the migrations. In all probability it breeds, but no eggs have been taken so far.

101. HUDSONIAN CURLEW. *Numenius hudsonicus.* (Lath.)
Two specimens were received at the State Museum from Craven County, spring of 1897.

Family CHARADRIIDÆ. Plovers.

102. BLACK-BELLIED PLOVER. S*quatarol squatarolḉa.* (Linn.)
Abundant during the migrations, especially in October; reported by Maynard as common at Southport in December, 1876.

103. AMERICAN GOLDEN PLOVER. *Squatarola dominicus.* (Mull.)
Rare transient in middle and mountain sections.

104. KILLDEER PLOVER. *Ægialitis vocifera.* (Linn.)
Common winter visitor in the east, arriving early in fall and remaining late in spring; tolerably common resident in the middle section; rare summer visitor in the mountains. Breeds wherever it spends the summer.

105. SEMIPALMATED PLOVER. *Ægialitis semipalmata.* (Bonap.) Transient visitor; common on the coast, rare in the middle section.

106. PIPING PLOVER. *Ægialitis melodia.* (Ord.) Common migrant on the coast.

107. WILSON'S PLOVER. *Ægialitis wilsonia.* (Ord.) Summer resident on the coast, breeding abundantly.

Family APHRIZIDÆ. Surf Birds and Turnstones.

108. TURNSTONE. *Arenaria interpres.* (Linn.) Very common on the coast during the migrations, and some may winter along the southern part.

Family HAEMATROPODIDÆ. Oyster-Catchers.

109. AMERICAN OYSTER-CATCHER. *Hæmatopus palliatus.* (Temm.) Observed by Maynard in November, 1876, at Southport, where they were evidently established for the winter. Several were exhibited at the Newbern Fair in 1892 in the meat, said to have been taken in the vicinity.

Family TETRAONIDÆ. Grouse, Partridges, etc.

110. BOB-WHITE. *Colinus virgininnus.* (Linn.) Common resident in all portions of the State, breeding abundantly throughout its range.

111. RUFFED GROUSE. *Bonasa umbellus.* (Linn.) This species is common on the higher mountains, where it breeds, not so common in the valleys as formerly. Confined entirely to the mountain section.

Family PHASIANIDÆ. Pheasants, etc.

112. WILD TURKEY. *Meleagris gallopavo.* (Linn.) Resident in all portions; common in the east, rarer westward. Breeds throughout its range. Eggs in my collection average larger than those of the domestic turkey.

Family COLUMBIDÆ. Pigeons.

113. PASSENGER PIGEON. *Ectopistes migratorius.* (Linn.) Accidental in the middle section; very rare transient in the mountains, passing above 1,000 feet.

114. MOURNING DOVE. *Zenaidura macroura.* (Linn.) Common resident throughout the State, breeding.

115. GROUND DOVE. *Columbigallina passerina terrestris.* (Chap.) Accidental summer visitor in the mountains, two specimens seen

and identified by Cairns. H. Gould Welborne says it is a rare summer resident in Davidson County, breeding. An egg in my collection taken by him must be of this species, as it conforms with other specimens of this species in my collection, in every particular. This is the most northern record of this species breeding.

Family **CATHARTIDÆ.** American Vultures.

116. TURKEY VULTURE. *Cathartes aura.* (Linn).
Common resident, generally distributed. Breeds in all sections. Usually known by the name "North Carolina Buzzard."

117. BLCK VULTURE. *Cathaista atrata.* (Bartr).
Common resident in the eastern and middle sections; not very common in the mountains; breeds. This is the "South Carolina Buzzard."

Family **FALCONIDÆ.** Vultures, Falcons, Hawks, Eagles, etc.

118. SWALLOW-TAILED KITE. *Elanoides forficatus.* (Linn).
A few seen every fall in the higher mountains. One specimen from Craven County in State Museum.

119. MARSH HAWK. *Circus hudsonius.* (Linn).
Common resident in the east, probably breeding; tolerably common winter visitor in the middle section; not a common autumn transient in the mountains.

120. SHARP-SHINNED HAWK. *Accipiter velox.* (Wils).
Tolerably common, generally distributed resident throughout the State. Cairns has observed it in Buncombe County.

121. COOPER'S HAWK. *Accipiter cooperi.* (Bonap.)
Common resident in all portions, breeding. Eggs are in my collection taken by Cairns in Buncombe County, and by myself in Beaufort County.

122. RED-TAILED HAWK. *Buteo borealis.* (Gmel.)
Rather rare resident throughout the State. Breeds. I took a set of two eggs in 1890, nest was placed in top of a swamp pine one hundred and twenty-seven feet high.

123. RED-SHOULDERED HAWK. *Buteo lineatus.* (Gmel.)
Common resident in all parts of the State. Breeds. Eggs are in my collection from Wake County.

124. SWAINSON'S HAWK. *Buteo swainsoni.* (Bonap.)
Accidental in the mountain region.

125. BROAD-WINGED HAWK. *Buteo latissimus.* (Wils.)
Rare summer visitor in the middle and mountain sections, breeding in both places,

126. AMERICAN ROUGH-LEGGED HAWK. *Archibuteo lagopus sancti-johannis.* (Gmel.)
Seen occasionally in winter and spring in the mountainous sections.

127. GOLDEN EAGLE. *Aquila chrysaetos.* (Linn.)
Tolerably common in the mountain section for an eagle. Breeds on the cliffs of the higher mountains.

128. BALD EAGLE. *Hallæetus leucocephalus.* (Linn.)
Common resident in the east; tolerably common in the mountains; not reported from the middle section. Breeds in both the eastern and western sections; common to the east; perhaps a dozen nests are on the banks of the Pamlico river.

129. DUCK HAWK. *Falco peregrinus anatum.* (Bonap.)
Nearly, if not quite, a resident in the mountain section. Breeds on the higher mountains.

130. PIGEON HAWK. *Falco columbarius.* (Linn.)
Rather rare transient in the middle and western sections.

131. AMERICAN SPARROW HAWK. *Falco spai verius.* (Linn.)
Common resident, generally distributed. Breeds throughout the its range.

132. AMERICAN OSPREY. *Pandion haliæetus carolinensis.* (Gmel.)
Common resident in the east; rare transient visitor in the middle section; rare summer visitor in the mountains. Breeds in both eastern and western sections.

Family STRIGIDÆ. Barn Owls.

133. AMERICAN BARN OWL. *Strix pratincola.* (Bonap.)
Reported as occasionally seen by Coues at Fort Macon; one started from a bunch of live oaks at Southport by Maynard in in 1876; one taken by James Moore at Newport in 1889; one taken near New Bern in 1892; one taken by Brimley near Raleigh in January, 1896.

FamilY BUBONIDÆ. Horned Owl.

134. AMERICAN LONG-EARED OWL. *Asio wilsonianus.* (Less.)
Bare winter visitor in the middle and western sections. One shot near Asheville in 1889, specimens taken near Raleigh in 1891 and 1893.

135. SHORT-EARED OWL. *Asio accipitrinus.* (Pall.)
Rare transient visitor in the middle and mountain sections.

136. BARRED OWL. *Syrnium nebulosum.* (Forst.)

Common resident, generally distributed. Breeds. Eggs are in my collection from Wake County.

137. SAW-WHET OWL. *Nyctala acadica.* (Gmel.)

A mounted specimen exhibited at the New Bern Fair in 1892; one female taken near Raleigh on December 18, 1894, by Brimley; one taken in Wake County December 4, 1897, and carried to the State Museum.

138. SCREECH OWL. *Megascops asio.* (Linn.)

Common resident, generally distributed throughout the State. Breeds. I have a set of three eggs from the middle section, have taken young ones on several occasions.

139. GREAT HORNED OWL. *Bubo virginianus.* (Gmel.)

Not a very common resident, though generally distributed. Probably breeds in all sections; eggs have been taken by Cairns and Brimley.

140. SNOWY OWL. *Nyctea nyctea.* (Linn.)

Cairns wrote me that he had seen a "white owl" once, and had been informed that it was often seen a few miles west of Weaverville during the winter months. A specimen received at State Museum December 4, 1897, from Pamlico County.

Family PSITTACIDÆ.

141. CAROLINA PAROQUET. *Conrus carolinensis.* (Linn.)

I think this species should hardly be classed among our birds, as the last record was that of Catesby in 1731, though South Carolina has a record in 1851. This species is now confined to Florida, and in all probability will never be found any further north, as it is rapidly becoming extinct.

Family CUCULIDIÆ. Cuckoos, Anis, Etc.

142. YELLOW-BILLED CUCKOO. *Coccyzus americanus.* (Linn)

Common summer visitor in the eastern and middle sections; irregular summer visitor in the mountains. Breeds throughout its range.

143. BLACK-BILLED CUCKOO. *Cocyzus erythrophthalmus.* (Wils.)

Rather rare summer visitor in all sections. Breeds. Eggs are in my collection from Bertie County, collected by R. P. Smithwick.

Family ALCEDINIDÆ. Kingfishers.

144. BELTED KINGFISHER. *Ceryle alcyon.* (Linn.)

Common resident in the eastern and middle sections; a common migrant in the west; few remaining throughout the summer. Breeds in all sections.

Family PICIDIÆ. Woodpeckers.

145. IVORY-BILLED WOODPECKER. *Campephilus principalis.* (Linn.)

Wilson took a specimen about twelve miles north of Wilmington, and carried it into the city ; this bird was slightly wounded in one of its wings. This was in the thirties of the present century. In a paper by Coues and Yarrow on the Natural History of Fort Macon, published in 1876, they say : "Information was received from an apparently good source of the occurrence of this species, whose appearance was described with tolerable exactness, but the statement is given for what it is worth, no specimen having been seen." May possibly be found in some of the deep swamps of the south-eastern part of the State at the present time.

146. HAIRY WOODPECKER. *Dryobates villosus.* (Linn.)
Rather rare resident in the western section. A few breed on the higher mountains.

147. SOUTHERN HAIRY WOODPECKER. *Dryobates villosus audobonii.* (Swains)
Generally distributed ; common resident throughout the State. Breeds ; have taken eggs in Bertie County.

148. SOUTHERN DOWNY WOODPECKER. *Dryobates pubescens.* (Linn.)
Common resident in all sections, breeding

149. DOWNY WOODPECKER. *Dryobates pubescens medianus.* (Linn.)
A resident of the higher mountains, probably breeding.

150. RED-COCKADED WOODPECKER. *Dryobates borealis.* (Veill.)
Tolerably common resident in the east, more numerous some seasons than others ; one female taken by Brimley at Raleigh, April 22, 1891. Breeds in the eastern section, several sets have been taken by R. P. Smithwick, one of which is at present in my collection.

151. YELLOW-BELLIED SAPSUCKER. *Sphrapicus varius.* (Linn.)
Tolerably common winter visitor in the middle sections ; resident in the western section, breeding on the higher mountains.

152. PILEATED WOODPECKER. *Ceophlœus pileatus.* (Linn.)
Resident in all portions ; common in the east, rarer westward. Breeds, probably, in all sections ; eggs have been taken by Cairns, and I have frequently seen nests in the eastern section.

153. RED-HEADED WOODPECKER. *Melanerpes erythrocephalus.* (Linn.)
Tolerably common resident in all portions. I have found it breeding in the east, and Cairns has taken eggs in the west.

154. RED-BELLIED WOODPECKER. *Melanerpes carolinus.* (Linn.)
Irregular resident in all portions ; sometimes common, at others rare. Breeds on Craggy mountains.

155. FLICKER. *Colaptes auratus.* (Linn.)

Generally distributed common resident throughout the State. Breeds in all portions. Eggs taken in the eastern and middle sections are in my collection.

Family CAPRIMULGIDÆ. Goatsuckers.

156. CHUCK-WILL'S-WIDOW. *Antrostomus carolinensis.* (Gmel.)

Common summer visitor in the eastern sections. Breeds. Eggs have been taken in Bertie, Edgecombe and Wake counties.

157. WHIP-POOR-WILL. *Antrostomus vociferus.* (Wils.)

Common summer visitor in all sections, generally distributed. Breeds.

158. NIGHTHAWK *Chordeiles virginianus.* (Gmel.)

Tolerably common summer visitor throughout the State. Breeds.

Family MICROPODIDÆ. Swifts.

159. CHIMNEY SWIFT. *Chœtura pelagica.* (Linn.)

Common summer visitor, generally distributed and breeding in all sections.

Family TROCHILIDÆ. Hummingbirds.

160 RUBY-THROATED HUMMINGBIRD. *Trochilus colubris.* (Linn.)

Common summer visitor in all portions of the State, breeding throughout its range Eggs are in my collections from all sections.

Family TYRANNIDÆ, Tyrant Flycatchers.

161. KINGBIRD. *Tyrannus tyrannus.* (Linn.)

Summer visitor, common in all portions. Common breeder throughout its range.

162. CRESTED FLYCATCHER. *Myiarchus crinitus.* (Linn.)

Common summer visitor in all portions ; common breeder.

163. PHŒBE. *Sayornis phœbe.* (Lath.)

Common summer visitor in all sections, a few wintering in the mountains. Eggs have been taken in the middle and western sections.

164. OLIVE-SIDED FLYCATCHER. *Contopus borealis.* (Swains.)

Rare summer visitor in the west ; breeding on the Black Mountains.

165. WOOD PEWEE. *Contopus virens.* (Linn.)

Common summer visitor throughout the State ; common breeder.

166. YELLOW-BELLIED FLYCATCHER. *Empidonax flaviventris.* (Baird.)

Rare transient in the middle section ; one taken on August 11, 1890, in the mountains.

167. GREEN-CRESTED FLYCATCHER. *Empidonax virescens.* (Gmel.)
Yery common summer visitor in all sections, breeding abundantly.

168. ALDER FLYCATCHER. *Empidonax traillii alnorum.* (Brewster.)
One taken by Cairns in the mountains, September, 1889; one taken in Wake County by Brimley, May, 1892.

169. LEAST FLYCATCHER. *Empidonax minimus.* (Baird.)
Rare summer visitor in the mountains. Observed breeding by Cairns.

Family ALAUDIDÆ. Larks.

170. HORNED LARK. *Otocoris alpestris.* (Linn.)
Winter visitor; rare in the middle section, tolerably common in the mountains.

171. PRAIRIE-HORNED LARK. *Otocoris alpestris practicola.* (Hench.)
Rare winter visitor in the mountains; tolerably but irregular, winter visitor in the middle section; specimens taken at Raleigh, winters of '86, '87, '93 and '95 in company with *O. alpestris.*

Family CORVIDÆ. Crows, Jays, Magpies, Etc.

172. BLUE JAY. *Cyanocitta cristata.* (Linn.)
Common resident, generally distributed. Breeds in all sections; eggs are in my collection from the mountains.

173. AMERICAN RAVEN. *Corvus corax sinuatus.* (Wngl.)
Cairns reported this species as a tolerably common resident in the western section, breeding on Craggy Mountains in March.

174. NORTHERN RAVEN. *Corvus corax principalis.* (Ridgw.)
Rather rare irregular winter visitor in the eastern section.

175. AMERICAN CROW. *Corvs Americanus.* (Aud.)
Resident, very common in the east, common in other sections. Breeds in all portions.

176. FISH CROW. *Corvus ossifragus.* (Wils.)
Very common resident in the east and along the coast, not so numerous in the summer. (Breeds.)

Family ICTERIDÆ. Blackbirds, Orioles, Etc.

177. BOBOLINK. *Dolichonyx oryzivorus.* (Linn.)
Common transient visitor in all sections. Some seasons large flocks appear in the eastern section and destroy much grain. Generally known by the name of "Rice Bird."

178. COWBIRD. *Molothrus ater.* (Bodd.)
Common spring transient in the mountains; common winter visitor in the middle and western sections.

179. RED-WINGED BLACKBIRD *Agelaius phœniceus.* (Linn.)
Common resident in the eastearn and middle sections; summer visitor in the mountains. Breeds; eggs are in my collection from the centrel and eastern sections of the State.

180. MEADOW LARK. *Sturnella magna.* (Linn.)
Common winter visitor in the middle and western sections, may be a rare summer resident in the mountains, said to breed near Asheville. Resident in the east, though not so common in summer; breeding.

180. ORCHARD ORIOLE. *Icterus spurius.* (Linn.)
Summer visitor; common in the western and middle sections, rather rare in the east. Breeds in all sections.

182. BALTIMORE ORIOLE. *Icterus galbula.* (Linn.)
Rare transient in the middle section; common summer visitor in the mountains, probably breeding. Have never observed it in the east.

183. RUSTY BLACKBIRD. *Scolecophagus carolinus.* (Mull.)
Tolerably common transient visitor in all sections.

184. PUPRLE GRACKLE. *Quiscalus quiscula.* (Linn.)
Transient visitor in the eastern and middle sections; rather rare summer visitor in the mountains. Has been observed breeding in Asheville, and reported breeding in Newbern.

185. BRONZED GRACKLE. *Quiscalus quiscula æneus.* (Ridgw.)
Five specimens were taken in Buncombe county on August 11, 1890, by Cairns; two specimens were taken at Raleigh by Brimley, November 14, 1893.

186. BOAT-TAILED GRACKLE. *Quiscalus major.* (Vill.)
Abundant resident in the east, confined mainly to the coast. Abundant breeder. I took a set of five eggs from an ivey-covered tree in Plymouth, in April, 1890; several pairs were nesting in the same tree at that time.

Family FRINGILLIDÆ. Finches, Sparrows, Etc.

187. PURPLE FINCH. *Carpodacus purpureus.* (Gmel.)
Common winter visitor in the eastern and middle sections; common spring transient in the mountains. Brewster thinks it breeds near Old Fort.

188. AMERICAN CROSSBILL. *Loxia curvirostra minor.* (Brehm.)
Rare transient in the middle section; resident in the west, a few breed on Black Mountain.

189. AMERICAN GOLDFINCH. *Spinus tristis.* (Wils.)
Common resident in the western and middle sections; common transient in the east. Breeds in middle and western sections, eggs are in my collection from both places.

190. PINE SISKIN. *Spinus pinus.* (Wils.)
Winter visitor in middle and western sections; common on the Black Mountains in summer, probably breeding.

191. LAPLAND LONGSPUR. *Calcarius lapponicus.* (Linn.)
Irregular winter visitor in the middle section; one was taken at Raleigh, January 13, 1893, and another seen on the following day; four specimens were taken, and another seen at Raleigh, February 20, 1895. They were in company with prairie-horned larks.

192. VESPER SPARROW. *Poocætes gramineus.* (Gmel.)
Common winter visitor in the eastern and middle sections; resident in the mountains. A set of eggs was taken by Joe H. Armfield, June 1, 1893, near Greensboro.

193. SAVNNNAH SPARROW. *Ammodramus sandwicensis savanna.* (Wils.)
Very common winter visitor throughout the State.

194. GRASSHOPPER SPARROW. *Ammodramus savannarum passerinus.* (Wils.)
Rare transient east of the central section; tolerably common summer visitor in the west, breeding. Eggs were taken by Armfield, near Greensboro, 1896.

195. HENSLOW'S SPARROW. *Ammodramus henslowii.* Aud.)
Rare transient in middle and western sections; one taken in Buncombe county by Cairns, April, 1890, one at Raleigh by Brimley, in 1895, and two specimens in April, 1894.

196. LECONTE'S SPARROW. *Ammodramu leconteii.* (Aud.)
One specimen taken by Brimley on edge of meadow adjoining Walnut Creek, In Wake county, April 21, 1894.

197. SHARP-TAILED SPARROW. *Ammodramus caudacutus.* (Gmel.)
This is a very common bird on the coast among the marshes, and I think it is resident. Common breeder.

198. SEASIDE SPARROW. *Ammodramus maritimus.* (Wils.)
What was said of the above species can also be said of this. I took a specimen in a marsh near plymouth, May 15, 1891; a number was seen on Bogue Beach, by H. H. Brimley, July 6, 1894. Breeds.

199. LARK SPARROW. *Chondestes grammacus.* (Say.)
Rare summer visitor at Raleigh. Breeds.

200. WHITE-CROWNED SPARROW. *Zonotrichia leucophrys* (Forst.)
Rare migrant in the west, young male taken October 16, 1889, in Buncombe county, by Cairns; accidental Raleigh.

201. WHITE-THROATED SPARROW. *Zonotrichia albicollis.* (Gmel.)
Abundant winter visitor in all sections of the State.

202. CHIPPING SPARROW. *Spizella socialis.* (Wils.)
Common summer visitor in the mountain and middle sections; resident in the east. Breeds throughout the State.

203. CLAY-COLORED SPARROW. *Spizella pallida.* (Swains.)
Only record is that of Atkinson, one taken at Chapel Hill, March 8, 1886.

204. FIELD SPARROW. *Spizella pucilla.* (Wils.)
Common, generally distributed resident throught all sections. Breeds.

205. ENGLISH SPARROW. *Passer domesticus.* (Linn.)
Common in town and villages, and rapidly going into the country. Breeds.

206. SLATE-COLORED JUNCO. *Junco hyemalis.* (Linn.)
Abundant winter visitor in all sections. " Snow Bird."

207. CAROLINA JUNCO. *Junco hyemalis carolinensis.* (Brewst.)
Common resident on the higher mountains of the western section, goes down into the valleys during the winter. Breeds.

208. BACHMAN'S SPARROW. *Peucæa æstivalis bachmanii.* (Aud.)
Summer visitor, tolerably common in the west, but rarer to the eastward; one seen at the Newbern Fair, February, 1892. Nests have been found ia Buncombe, Guilford, Orange, and Wake counties. Found breeding, by Maynard, at Wilmington, June, 1876.

209. SONG SPARROW. *Melospiza fasciata.* (Gmel.
Common winter visitor throughout all portions of the State.

210. LINCOLN'S SPARROW, *Melospiza lincolni.* (Aud.)
One male taken by Cairns, May 6, 1893, on the French Broad River.

211. SWAMP SPARROW. *Melospiza georgiana.* (Lath.)
Common wintr visitor ln the eastern and middle sections; common transient in the mountains.

212. FOX SPARROW. *Passerella iliaca.* (Merr.)
Common winter visitor in all sections.

213. TOWHEE. *Pipilo erythrophthalmus.* (Linn.)
Nearly, if not quite a resident in the east; winter visitor in the middle section; resident in the mountains. Breeds in the west.

214. CARDINAL. *Cardinalis cardinalis..* (Linn.)
Common resident in all portions, breeding. Known as "Red Bird."

215. ROSE-BREASTED GROSBEAK. *Lamaladia ludoviciana.* (Linn.)
Rare migrant in the middle section; summer visitor on the higher mountains, breeding on Craggy mountains.

216. BLUE GROSBEAK. *Guiraca cærulea.* (Linn.)
Tolerably common summer visitor in the middle section, where it breeds; rare summer visiror in the mountains.

217. INDIGO BUNTING. *Passerina cyanea.* (Linn.)
Comman summer visitor in all portions, breeding throughout its range.

218. PAINTED BUNTING. *Passerina ciris.* (Linn.)
Tolerably common summer visitor in the southeastern portion of the State. One taken on Bogue Banks, July 6, 1894, by H. H. Brimley.

Family TANAGRIDÆ. Tanagers.

219. SCARLET TANAGER. *Piranga erythromelas.* (Veiil.
Common Summer visitor in the mounfains, breeding; rather rare transient in the middle section.

220. SUMMER TANAGER. *Piranga rubra.* (Linn.)
Common summer visitor in all sections, breeding. This is the "Little Red Bird."

Family HIRUNDINIDÆ. Swallows.

221. PURPLE MARTIN. *Progne subis.* (Linn.)
Tolerably common summer visitor in all portions, breeding in boxes.

222. CLIFF SWALLOW. *Petrochelidon lunifrons.* (Say.)
Tolerably common transient in the middle and mountain sections.

223. BARN SWALLOW. *Chhlidon erythrogaster.* (Bodd.)
Transient; common in the middle section, rare in the mountains; not observed in the east.

224. WHITE-BELLIED SWALLOW. *Tachycineta bicolor.* (Veill.)
Commn Migrant in the middle and eastern portions of the State; winters in the southeastern section.

225. BANK SWALLOW. *Clivicola riparia.* (Linn.)
Rare transient in the middle and mountain sections.

226. ROUGH-WINGED SWALLOW. *Stelgidopteryx serripennis.* (Aud.)
Tolerably common summer visitor, generally distributed. Breeds. nesting in banks of rivers and in ledges on mountain sides.

Family AMPELIDÆ. Waxwings.

227. CEDAR WAXWING. *Ampelis cedorum.* (Veill.)

Common, nearly if not quite resident in the east, resident in the other sections. Breeds in the middle and western sections.

Family LANIIDÆ. Shrikes.

228. LOGGERHEAD SHRIKE. *Lanius ludovicianus.* (Linn.)

Rare spring transient in the mountains; tolerably common winter visitor in the middle section. Reported breeding at Statesville.

Family VIREONIDÆ. Vireos.

229. RED-EYED VIREO. *Vireo olivaceus.* (Linn.)

Common summer visitor in all sections, breeding throughout its range.

230. PHILADELPHIA VIREO. *Vireo philadelphicus.* (Cass.)

Rare transient in the mountains, one taken by Cairns.

231. WARBLING VIREO. *Vireo gilvus.* (Veill.)

Tolerably common summer visitor in the mountains, breeding along the streams.

232. YELLOW-THROATED VIREO. *Vireo flavifrons.* (Veill.)

Tolerably common summer visitor in the middle and mountain sections.

233. BLUE-HEADED VIREO. *Vireo solitarius.* (Wils.)

Tolerably common transient in the middle section, and seen occasionally in winter; rather rare summer visitor in the mountains.

234. MOUNTAIN SOLITARY VIREO. *Vireo solitarious alticola.* (Brewst.)

Rare summer visitor at Raleigh, nest with four eggs taken April 27, 1891; common summer visitor in the mountains, breeding.

235. WHITE-EYED VIREO. *Vireo noveborarencis.* (Gmel.)

Common summer visitor in all sections, breeding throughout its range.

Family MNIOTILTIDÆ. Wood Warblers.

236. BLACK AND WHITE WARBLER. *Mniotilta varia.* (Linn.)

Common, generally distributed summer resident, breeding in all sections.

237. PROTHONOTARY WARBLER. *Protonotaria citrea.* (Aud.)

Rare summer visitor in the middle section; common in the east. Breeds; I took one set of three eggs from the top of a beech stump in Bertie county in spring of 1888, this was the first record for North Carolina. Have seen young receiving attention from their parents on many occasions since.

238. SWAINSON'S WARBLER. *Helinaia swainsonii.* (Aud.)
No record except that of Atkinson: "One specimen taken by H. H. Brimley, at Newbern, April 13, 1885."

239. WORM-EATING WARBLER. *Helmitherus vermivorus.* (Gmel.)
Not a common summer visitor in any section, though generally distributed and occurring regularly. Nests with eggs have been found in Bertie and Buncombe counties.

240. BACHMAN'S WARBLER. *Helminthophila bachmani.* (Aud.)
One specimen taken by Brimley near Raleigh, April 27, 1891. Probably a rare summer visitor.

241. BLUE-WINGED WARBLER. *Helminthophila piuus.* (Linn.)
Rare transient in the middle section; rare summer visitor in the mountains, said to be common in the most western counties. Nest with young ones taken by Cairns, in 1885.

242. BREWSTER'S WARBLER. *Helminthophiia lencobronchialis.* (Brewst.)
Probably transient in the middle section, one taken by Brimley, September 8, 1888.

243. GOLDEN-WINGED WARBLER. *Helminthophila crysoptera.* (Linn.)
Rare transient in the middle section; one taken by Brimley, in Wake county, August 26, 1886, one May 7, 1889, and one in May, 1891; tolerably common summer visitor in the mountains, breeding in May.

244. NASHVILLE WARBLER. *Helminthophila rubricapilla.* (Wils.)
Not a common transient in the mountains.

245. ORANGE-CROWNED WARBLER. *Helminthophila celata.* (Say.)
One male specimen has been taken in the mountains by Cairns.

246. TENNESSEE WARBLER. *Helmintnophila peregrina.* (Wils.)
Rare transient in the middle and western sections.

247. PARULA WARBLER. *Comsothlypis americana.* (Linn.)
Common summer visitor in all portions, breeding throughout its range.

248. NORTHERN PARULA WARBLER. *Compsothlypis americana usneæ.* (——.)
Transient in the middle section, reported by Brimley, at Raleigh.

249. CAPE MAY WARBLER. *Dendroica tigrina.* (Gmel.)
One female taken by Cairns in Buncombe county, and two specimens taken by Brimley in spring of 1892, near Raleigh.

250. YELLOW WARBLER. *Dendroica æstiva.* (Gmel.)
Common resident in the mountain and middle sections, breeding. Common migrant in the east.

251. BLACK-THROATED BLUE WARBLER. *Dendroica cærulescens.* (Gmel.)
Common transient in the eastern and middle sections; summer visitor in the west, breeding above 4,000 feet. A set of eggs is in my collection, taken in Buncombe county by Cairns.

252. CAIRNS' WARBLER. *Dendroica cærulescens cairnsi.* (—.)
First discovered and described by the late John S. Cairns. Breeds in the western part of the State.

253. MYRTLE WARBLER. *Dendroica coronata.* (Linn.)
Common transient in the east, sometimes appearing in flocks; winter visitor in the middle and western sections.

254. MAGNOLIA WARBLER. *Dendroica maculosa.* (Gmel.)
Rare transient in the middle section; summer visitor in the mountains, and Cairns says he thinks it must breed, as young ones are common in July.

255. CÆRULEAN WARBLER. *Dendroiea rara.* (Wils.)
Rare transient, confined to the middle and mountain sections.

256. CHESTNUT-SIDED WARBLER. *Dendroica pensylvanica.* (Linn.)
Tolerably common transisnt in the middle section; common summer resident in the west, on the higher mountains. Breeds, nest was found by Cairns in Buncombe county, May 25, 1887.

257. BLACK-POLL WARBLER. *Dendroica striata.* (Forst.)
Transient; common in the eastern and middle sections, rather rare in the mountains.

258. BLACKBURNIAN WARBLER. *Dendroica blackburniæ.* (Gmel.)
Rare transient in the middle section; common resident on the higher mountains. Breeds.

259. YELLOW-TROATED WARBLER. *Dendroica dominica.* (Linn.)
Rather common, generally distributed, summer visitor throughout the State. Probably breeds in all sections; eggs have been taken in Wake county.

260. SYCAMORE WARBLER. *Dendroica dominica albilora.* (Linn.)
One female taken in Buncombe county by Cairns, April, 1891.

261. BLACK-THROATED GREEN WARBLER. *Dendroica virens.* (Gmel.)
Tolerably common transient in all portions of the State except the higher mountains, where it is a summer resident, and breeds.

262. PINE WARBLER. *Dendroica vigorsii.* (Aud.)
Common resident in the eastern and middle sections; common in the mountain region in summer, not so common in winter. Breeds commonly in all sections.

263. YELLOW PALM WARBLER. *Dendroica palmarum hypochrysea.* (Ridgw.)
Tolerably common transient in all sections.

264. PRAIRIE WARBLER. *Dendroica discolor.* (Veill.)
Common summer visitor in all portions except, probably, the higher mountains. Breeds throughout its range.

265. OVEN-BIRD. *Seiurus aurocapillus.* (Linn.)
Common transient and not a rare summer resident in the eastern section; migrant in the middle section; common summer sojourner in the mountains. Eggs have been taken in the eastern and western sections.

266. WATER-THRUSH. *Seiurus noveboracensis.* (Gmel.)
Common transient in the middle and mountain sections.

267. LOUISIANA WATER-THRUSH. *Seiurus montacilla.* (Veill.)
Tolerably common summer visitor, and breeds in all sections. Eggs in my collection are from all sections.

268. KENTUCKY WARBLER. *Geothlypis formosa.* (Wils.)
Summer visitor; rare in the middle section, tolerably common in the mountains. Breeds in both sections.

269. CONNECTICUT WARBLER. *Geothlypis agilis.* (Wils.)
Rare fall migrant at Raleigh; one taken October 15, 1884; two specimens seen in October, 1896.

270. MARYLAND YELLOW-THROAT. *Geothlypis trichas.* (Linn.)
Common summer visitor in the middle and western sections; a few winter at Raleigh; resident in the east, not so common in winter. Breeds in all sections.

271. YELLOW-BREASTED CHAT. *Icteria virens.* (Linn.)
Common summer visitor in the middle and mountain sections. Breeding. Have never observed it in the east.

272. HOODED WARBLER. *Sylvania mitrata.* (Gmel.)
Summer visitor; rather rare in the middle and mountain sections; very common in the east, breeding abundantly. Have found as many as three nests in an hour's walk; eggs are usually four, sometimes three, and rarely two in number.

273. WILSON'S WARBLER. *Sylvania pusilla.* (Wils.)
Rare transient in the middle and mountain sections; specimens taken in Wake county May 17, 1888, and May 13, 1892.

274. CANADIAN WARBLER. *Sylvania canadensis.* (Linn.)
Summer visitor in the west; common on the high mountains, where it breeds. One male taken at Raleigh May 13, 1892.

275. AMERICAN REDSTART. *Setophaga ruticilla.* (Linn.)
Common transient in the east, rarely seen in summer; summer visitor in the middle and mountain sections, breeding.

Family **MONTACILLIDÆ.** Wagtails.

276. AMERICAN PIPIT. *Anthus pensylvanicus.* (Lath.)
Common winter visitor in the eastern and middle sections; rare transient in the mountains.

Family **TROGLODYTIDÆ.** Wrens, Thrashers, etc.

277. MOCKINGBIRD. *Mimus polyglottis.* (Linn.)
Abundant resident in the east; resident at Raleigh, only a few remaining through the winter, however; rare summer visitor in the mountains. Breeds in all sections.

278. CATBIRD. *Galeoscoptes carolinensis.* (Linn.)
Very common summer resident, breeding in all sections. Not unusual during the winter in the east; accidental at Raleigh.

279. BROWN THRASHER. *Harporhynchus rufus.* (Linn.)
Common resident in the eastern and middle sections; summer visitor in the mountains. Breeds.

280. CAROLINA WREN. *Thryothorus ludovicianus.* (Lath.)
Common resident in the eastern and middle portions; summer visitor in the mountains. Breeds throughout its range.

281. BEWICK'S WREN. *Thryomanes bewickii.* (Aud.)
Resident on the higher mountains of the west, more common in summer; rare winter visitor at Raleigh. Breeds in the mountains.

282. HOUSE WREN. *Troglodytes œdon.* (Veill.)
Rare transient in the middle and mountain sections.

283. WINTER WREN. *Troglodytes hyemalis.* (Veill.)
Common winter visitor in the eastern and middle sections; not an uncommon resident in the mountains, breeding on the higher mountains.

284. SHORT-BILLED MARSH WREN. *Cistothorus stellaris.* (Licht.)
One specimen seen by Coues at Fort Macon, October, 11, 1869; a few seen at Pungo Bluff, November 13, and common at Juniper Bay 15th and 16th of same month, 1876, by Maynard; rare autumn transient in the mountains.

285. Long-billed Marsh Wren. *Cistothorus palustris.* (Wils.) Abundant during the migrations in the east, and may reside sparingly throughout the year; rather common transient in the middle and mountain sections.

Family CERTHIIDÆ. Creepers.

286. Brown Creeper. *Certhia famaliaris americana.* (Bonap.) Common winter visitor in the eastern and middle sections; not a very common resident in the west. A nest with four eggs was taken in 1887 by Cairns in the mountains.

Family PARIDÆ. Nuthatches and Tits.

287. White-breasted Nuthatch. *Sitta carolinensis.* (Lath.) Tolerably common resident in all sections, breeding throughout its range.

288. Red-breasted Nuthatch. *Sitta canadensis.* (Linn.) Rather rare and irregular winter resident in the middle section; resident on the higher mountains, breeding.

289. Brown-headed Nuthatch. *Sitta pusilla.* (Lath.) Common resident in the middle and eastern sections, breeding throughout its range.

290. Tufted Titmouse. *Parus bicolor.* (Linn.) Resident, common and generally distributed. Breeds in all sections.

291. Chickadee. *Parus atricapillus.* (Linn.) Resident in the mountains above 5,000 feet, breeds.

292. Carolina Chickadee. *Parus carolinensis.* (Aud.) Common resident in all sections. Common breeder.

Family SYLVIIDÆ. Warblers, Kinglets, anh Gnatcatchers.

293. Golden-crowned Kinglet. *Regulus satrapa.* (Licht.) Common winter visitor in the eastern and middle sections; resident in the west, breeding on Black Mountains above 5,000 feet.

294. Ruby-crowned Kinglet. *Regulus calendula.* (Linn.) Common winter visitor in the eastern and middle sections; transient in the mountains.

295. Blue-gray Gnatcatcher. *Polioptila cærulea.* (Linn.) Common summer visitor, generally distributed. Breeds in all sections.

Family TURDIDÆ. Thrushes, Solitares, Stonechats, Bluebirds, etc.

296. Wood Thrush. *Turdus mustelinus.* (Gmel.) Very common summer visitor in all sections, breeds.

297. WILSON'S THRUSH. *Turdus fuscescens.* (Steph.)
Rather common transient in the eastern and middle sections; common summer visitor in the mountains.

298. GRAY-CHEEKED THRUSH. *Turdus aliciæ.* (Baird.)
Transient visitor, rare in the middle section; common in the mountains.

299. BICKNELL'S THRUSH. *Turdus aliciæ bicknelli.* (Ridgw.)
Transient visitor, rare in the middle section; common in the mountains.

300. OLIVE-BACK THRUSH. *Turdus ustulatus swainsonii.* (Cab.)
Rare transient in the middle section; summer visitor in the west. Breeds. Nest found May 20, 1886, by Cairns, on the Black Mountains.

301. HERMIT THRUSH. *Turdus aonalaschkæ pallasii.* (Cab.)
Common winter visitor in all sections.

302. AMERICAN ROBIN. *Merula migratoria.* (Linn.)
This species is an abundant transient and winter visitor in the east, a few remaining all the summer and breeding; tolerably common resident and migrant in the middle section; common resident in the mountains, rarer in winter. Breeds in all sections.

303. BLUEBIRD. *Sialia sialis.* (Linn.)
Was a common resident, but last few years has not been so common, generally distributed. Breeds in all sections.

HYPOTHETICAL LIST.

In this list are given species which ought to occur on the coast or within the borders of the state, as they occur both north and south, and in many instances, to the westward also.

1. Parasitic Jæger. *Stercorarius parasiticus.* (Linn.)
2. Long-tailed Jæger. *Stercorarius longicaudas.* (Veill.)
3. Great Black-tailed Gull. *Larus marinus.* (Linn.)
4. Gull-billed Tern. *Gelochelidon nilotica.* (Hasselq.)
5. Caspian Tern. *Sterna tschegrava.* (Lepech.)
6. Wilson's Petrel. *Oceanites oceanicus.* (Kuhl.)
7. Booby. *Sula sula.* (Linn.)
8. Man-o'-War Bird. *Fregata aquila.* (Linn.)
9. White Ibis. *Guara alba.* (Linn.)
10. Glossy Ibis. *Plegadis autumnalis.* (Hasselq.)
11. Whooping Crane. *Grus americana.* (Linn.)
12. Sandhill Crane. *Grus mexicana.* (Mull.)
13. Red Phalarope. *Crymophilus fulicarius.* (Linn.)
14. Black-necked Stilt. *Himantopus mexicanus.* (Mull.)
15. Stilt Sandpiper. *Micropalama himantopus.* (Bonap.)
16. Purple Sandpiper. *Tringa maritima.* (Brunn.)
17. Western Sandpiper. *Ereunetes occidentalis.* (Lawr.)
18. Hudsonian Godwit. *Limosa hæmastica.* (Linn.)
19. Buff-breasted Sandpiper. *Tringites subruficollis.* (Veill.)
20. Hudsonian Curlew. *Numenicus hudsonicus.* (Lath.)
21. Eskimo Curlew. *Numenius borealis.* (Forst.)
22. American Goshawk. *Accipiter atricapillus.* (Wils.)

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The Director's office is in the main building of the College. Telephone No. 135 C. The street cars pass within one hundred yards of the College building. The Station is glad to receive any inquiries on agricultural subjects. *Address all communications to the Agricultural Experiment Station, and not to individuals.* They will be referred to the members of the Station staff most competent to answer them.

CRIMSON CLOVER.

F. E. EMERY, AGRICULTURIST.

I. EXPERIMENTS AT THE N. C. AGRICULTURAL EXPERIMENT STATION.

The use of crimson clover as a soil improver began on the Experiment Farm in the fall of 1889, when it was sown after pea-vines (among the vines) to continue through the winter the work of improvement begun by the pea-vines. Seeds were saved in 1890 by stripping. This method was considered necessary because of the low growth among the stones on the slope which was being improved.

The following year this clover was sown more extensively*. It was sown among pea-vines on the south front of the buildings, and on the northeast where the pea-vines had followed immediately after a soil (fertilizer) test with cotton. It is possible clover had been sown and failed before the pea-vines, but the pea-vines were the first growth after the cotton. The cotton was said to have yielded about 20 per cent. of an average crop. The best yield was where two 2-horse loads of stable manure had been applied to one-twentieth-acre plat; 870 pounds of seed cotton per acre. The old pea-vines showed a more luxuriant growth on this plat, and the clover was fit for hay on April 24th, 1891. The growth of pea-vines and clover over these soil-test plats corresponded very well as shown by notes taken just before plowing. The combinations which were effective in increasing growth were of acid phosphate, kainit, cotton-seed meal. The stable manure was the only single application, the residual value of which seemed to have done the pea-vines and clover much good. Kainit and cotton-seed meal gave a very good growth of both pea-vines and clover; better than a one-horse load of stable manure.

A complete combination of 15 pounds acid phosphate with 7½ pounds cotton-seed meal and 3½ pounds kainit had about the same effect that 10 pounds kainit and 15 pounds acid phosphate had on another plat. All three of these chemicals, applied at rate of 10 pounds each, gave a slightly better growth than did either of the last named, but not equal to one 2-horse load of stable manure.

This shows something of the status of the land and what was required to make it grow clover. A coat of stable manure over the parts which showed the need gave good results in a crop of corn* which immediately succeeded this clover.

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*This beginning was made by J. R. Chamberlain, B. S., Agriculturist. The second year's sowing was done by him as Professor of Agriculture and his students in practice-work.

During 1891 hay was made from crimson clover grown after cow-pea-vines. This hay was fed in several digestion experiments which were reported in Bulletins 87d and 97.

In 1891 a small area, previously in millet and manured, was sown to crimson clover with barley, hoping to use the barley for soiling, but the fall proved too dry for barley and it grew just enough to afford protection for the clover, and in the spring of 1892 these crops came off together and made a very heavy yield of good hay.

In 1892, following a rather poor crop of oats, about 1 7/8 tons of stable manure and 1,080 pounds decayed silage were put on the poorer parts of a lot measuring 1 3/8 acres, and on August 24th crimson clover was sown after fitting the land well. This was cut for seed May 26, 1893, and proved a very good crop. This seed was distributed throughout the State.†

At the market price for seed in chaff, and estimating the hay as equivalent to the over-ripe pressed hay in the Raleigh market this crop was estimated at $100 per acre.

Following the above crop on a larger scale, about five acres were sown after soy-beans which had been ensiloed. The bean stubble was cut over with cutaway harrow, then black cow-peas drilled in with wheat drill in every third tube, putting the drills two feet apart and crimson clover seed in chaff, sown at the rate of 54 pounds of chaff per acre ahead of the drill. (This was considerable heavier seeding than needed, but sowers could not seem to gage the rate of sowing light enough). Harrowed with smoothing-harrow after sown.

A part of this field was mown and all was grazed in October. The clover and pea-vines were from one to one-and-a-half-feet tall. The following March the most forward part was frozen back severely by the freeze of 27th inst. It was on this portion that the barley and clover above mentioned was grown, and where the mowing was done in October for soiling purposes. This field was ripened for seed from the first crop. A portion of it was storm beaten before cut, but still the yield was profitable.‡

Crimson clover has been grown in alternation with corn to be ensiloed for several years, with varied successes and failures. The latter have been mainly due to hot, dry weather soon after seeding, or when such weather has continued almost the entire fall. One such failure to germinate seed until very late—too late for a satisfactory development of the crop in an ordinary season—proved a success by having been followed by a late, cool, wet spring, that of

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*B. 89, p. 27.

†Press B. 51 and 61, also B. 96, p. 80, and B. 103, p. 253.

‡See Press Bulletins 64 and 65, also same matter in B. 115, pp. 165 and 170.

1895. Clover seed was sown in September (12th) among a soiling crop of corn and pea-vines. The seed was in hulls and laid on the surface at least a month before it vegetated and grew. The yield of rather damp hay harvested May 17th to 23d was over 2 1-5 tons per acre.

Since many bulletin readers do not keep files of these articles, and thousands of new names have been added to the station mailing list since the articles referred to above were printed, it is deemed advisable to reprint some of the articles. They are thus given below to new readers and to those who may care to review, without going to the trouble of hunting up lost pamphlets.

[‖]Digestion of Crimson Clover Hay by One Goat and One Sheep.

(Date of experiment, November, 1891.)

The Preliminary Period for the gray goat was 8 days, and for the hornless sheep 8 days. The goat ate 771.1 grams of hay daily. The sheep ate 399.2 grams of hay per day.

During the Collection Period of 6 days the goat ate 811.9 grams of hay and drank 1129.5 grams of water daily. The sheep ate 403.7 grams and drank 621.4 grams water per day.

The goat weighed one-fourth pound less at the end of the collection period than the average for the 8 preceding days, while the sheep fell off from an average of 53 pounds to 49 pounds at the close of the collection period. The clover hay fed was prepared the same as the corn fodder. An aliquot sample was taken at each feed and preserved in air-tight jars till ready to analyze.

Analytical and Other Data for Obtaining the Coefficients of Digestibility. See Tables III and IV.

The composition of crimson clover hay and the coefficients of its digestibility show it to be a highly nutritious food. To bring out more clearly its nutritive value, comparison is made below with other well known and highly prized leguminous plants in a table showing the actual amounts of digestible nutrients in one hundred pounds of dry matter of each.

	Protein.	Carbohydrates.	Fats.	Ratio 1 to
Alfalfa hay, average of O'Brine[*] and N. Y. Ag. Ex. Station[†]	10.55	44.31	1.35	4.52
Alsike clover hay—Jordan[‡]	9.31	46.96	2.76	5.78
Red clover hay—Armsby[§]	6.64	42.64	0.80	6.72
Crimson clover hay (this experiment)	12.45	43.70	1.25	3.76

Scarlet clover (Trifolium incarnatum) is known under a variety of common names—Annual, German, Scarlet and Italian. This clover is easily grown, and should come into quite general use. It is an annual, and consequently must be re-seeded for each crop, which makes it important to grow seed at home. Seed may be sown from July to October, but the land should always be well prepared for it, or, if not, it should be well shaded, as under a good growth of cow-pea-vines, or in a corn or cotton crop, when the seed should be sown when the crop is laid by. Grown in this way it may be of great service in enriching and holding the land from washing. Its growth is made in the cool, wet part of the year, and it is ready to be made into hay at a season when planters are waiting for cotton to vegetate for first

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[‖] From B. 87d.
[*] Bulletin No. 8. Col. Ag. Exp't Sta.
[†] Eighth Annual Report. p. 143.
[‡] Maine Ag. Exp't Sta., Ann. Rep. 1889, part 2.
[§] Univ. of Wisc., Ag. Ex. Sta. Bulletin No. 3.

TABLE III.—SHOWING PERCENTAGE COMPOSITION CRIMSON CLOVER, WASTE, AND SOLID EXCREMENT.

	Water.	Dry Matter.	DRY MATTER CONTAINS.							
			Ash.	Protein. (N×6 25.)	Albuminoids. (Alb. N×6.25.)	Fats. (Eth. Ext.)	N-Free Extract.	Crude Fiber.	Total. Sugars.	St'rch
Crimson clover hay....	10.85	89.15	9.20	18.01	14.02	2.57	41.67	28.55	2.67	11.14
Waste, crims'n clov'r hay—Gray Goat	10.58	89.42	10.63	19.50	15.65	2.81	39.18	27.88	2.32	10.02
" " —Hornless Sheep	10.83	89.17	9.89	21.73	16.96	2.60	41.07	24.71	2.33	9.95
Solid excrement—Gray Goat.......	58.43	41.57	10.39	13.86	13 86	3.53	31.70	40.52	....	9.53
" " —Hornless Sheep..	53.77	46.23	11.75	14.02	14.02	3.38	31.60	39.25	....	9.81

TABLE IV.—SHOWING NUTRIENTS CONSUMED AND EXCRETED IN GRAMS, WITH PERCENTAGES DIGESTED.

GRAY GOAT.

	Total Am'nt	Dry Matter.	DRY MATTER CONTAINS.								
			Ash.	Protein. (N×6.25.)	Albuminoids. (Alb.N×6.25.)	Fats. (Eth. Ext)	N-Free Extract.	Crude Fiber.	Total Sug'rs	St' rch	Undetermined Carbohydrates
Crimson clover hay fed..	5400.	4814.1	442.9	867.0	674.9	123.7	2006.0	1374.4	128.54	536.29	1341.17
" " waste	518.	463.2	49.2	90.3	72.5	13.0	181.5	129.1	10.75	46 41	124.33
Total consumed.........	4882.0	4350.9	393.7	776.7	602.4	110.7	1824.5	1245.3	117.79	489.88	1216.84
Total solid excrement ...	4245.5	1764.8	183.3	244.6	244.6	62.3	559.4	715.1	......	168.19	391.21
Total digested..........	......	2586.1	210.4	532.1	357.8	48.4	1265.1	530.2	117.79	321.69	825.63
Per cent. digested.......	......	59.44	53.44	68.52	59.39	43.72	69.34	42.57	100.00	65.66	67.85

HORNLESS SHEEP.

	Total Am'nt	Dry Matter.	Ash.	Protein. (N×6.25.)	Albuminoids. (Alb.N×6.25.)	Fats. (Eth. Ext)	N-Free Extract.	Crude Fiber.	Total Sug'rs	St' rch	Undetermined Carbohydrates
Crimson clover hay fed..	3600.0	3209.4	295.2	578.0	449.9	82.8	1337.3	916.3	85.69	357.53	894.08
" " waste	1173.0	1046.0	103.4	227.3	177.4	27.2	429.6	258.5	24.37	104 08	301.15
Total consumed.........	2427.0	2164.3	191.8	350.7	272.5	55.6	907.7	657.8	61.32	253 45	592.93
Total solid excrement ...	1638.0	757.2	88.9	106.1	106.1	25.6	239.3	297.2	.....	74.28	165.02
Total digested..........	......	1406.2	102.9	244.6	166.4	30.0	668.4	360.6	61.32	179 17	427.91
Per cent. digested......	......	65.00	53.65	69.75	61.06	53.96	73.63	54.82	100.00	70.67	72.17
Average per cent. digest'd	......	62.22	53.55	69.14	60.23	48.83	71.49	48.70	100.00	68.16	70.01

Mean nutritive ratio of crimson clover hay, 1: 3.76.

working. This is often a dry time, and the hay can be quickly and easily cured. It may often be best to sow this clover with oats, rye or barley, and cut all for hay in April or May, as above.

This clover will thrive on land in moderate condition, but, like some other forage plants, will pay best where given a rich soil.

The high protein content, large proportion of amides and narrow ratio are especially noticeable in this hay. It is so rich, that for any use, it may well be fed with some such fodder as straw, meadow hay, or cotton-seed hulls. When fed for production of milk, the addition of corn, or corn and oats, will tend to widen the ratio, and probably add to the good qualities of the product.

*8. *One-year-old crimson clover hay.*—The digestibility of a portion of this same lot of hay was determined when new and reported last year. Its digestibilty was re-determined a year later to see if it had changed in composition and digestibility, and to be used in other experiments. The old hay had suffered a loss of 1 per cent. in nitrogen compounds and slight changes in other constituents, but there was very little difference in the digestibility of the two hays beyond a small decrease in the digestibility of the fats and nitrogen-free extract of the old hay.

9–10. *Rations of crimson clover hay and cotton-seed meal.*—The digestibility of four rations of crimson clover hay aud cotton-seed meal were determined, viz.: 6.4 to 1, 3.53 to 1, 3.5 to 1, and 3.09 to 1. They were all digested well and make good showings for the rations, but they are too heavy for ordinary feeding. Their digestibility were determined to arrive at the digestibility of cotton-seed meal, which could not be fed alone, and the results obtained for this latter material confirm our high opinion of it as being our most valuable concentrated food.

15. *Rations of crimson clover hay and corn meal, 2.36 to 1 and 1.83 to 1.*—These rations have a very high rate of digestibility and the proportion of nutrients in them are good, far better than in corn meal alone, and would be good rations for milk, for first period of fattening of steers, or for horses or oxen at work.

17. *Rations of crimson clover hay and corn-and-cob meal, 1.8 to 1, and 1.35 to 1.*—These rations have quite a high rate of digestibility, and the proportion of the food constituents in the ration of 1.8 pounds hay to 1 pound corn-and-cob meal are such as to recommend the ration for the same purposes as given for the rations of crimson clover hay and corn meal in paragraph 15. The nutritive ratio of the ration of 1.35 pounds hay to 1 pound meal is rather wide for most feeding purposes.

†CRIMSON CLOVER FOR HAY OR SEED.

Crimson clover (trifolium incarnatum) is known under a variety of common names—Annual, German, Scarlet, and Italian. This clover is easily grown, and should come into quite general use. It is an annual, and consequently must be reseeded for each crop, which makes it important to grow seed at home. Seed may be sown from July to October, but the land should always be well prepared for it, or, if not, it should be well shaded, as under a growth of cow-pea vines, or in a corn or cotton crop, where the seed should be sown when the crop is laid by. Grown in this way it may be of great service in enriching and holding the land from washing. Its growth is made in the cool, wet part of the year, and it is ready to be made into hay at the season when planters are waiting for cotton to vegetate for first working. This is often a dry time, and the hay can be quickly and easily cured. It may often be best to sow this clover with oats, rye or barley, and cut all for hay in April or May.

This clover will thrive on land in moderate condition, but, like some other forage plants; will pay best where given a rich soil. The composition of crimson clover hay shows it to be a highly nutritious food. It is so rich that for any use it may well be fed with some such fodder as straw, meadow hay, or cotton-seed hulls. When fed for production of milk, the addition of corn, or corn and oats, will tend to add to the good qualities of the product.

The seed distributed in 1893 by the N. C. Experiment Station is part of a crop of 2,687 pounds from 1⅜ acres, which is at the rate of 1,956 pounds of seed in chaff per acre. We have made some tests on this, which if true for the whole lot of seed, would yield at the rate of 757.95 pounds, or 12⅝ bushels per acre of clean seed. This seed usually sells at retail for ten cents per pound, and dealers are now paying $5.50 per bushel for it. The long, well-filled heads warrant this a good cash crop where a good stand can be secured on land in fair condition. It can be grown in orchards for the improvement of the soil, as in Delaware, where it has come to be a standard crop. The one drawback is that a special machine must be used to clean the seed. A clover seed huller is expensive, but could clean the seed of a whole township, and perhaps a whole county, by moving around as is usual with threshing machines.

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*Bulletin 97.

†Press B. 51 also reprinted in No. 61.

There are several advantages in growing annual clover sufficient to induce its cultivation from purchased seed, but if, instead of buying seed, it can be grown at a profit and add one more to the cash crops, how much better to take such steps as will insure its general planting.

In maturing a crop of seed care should be exercised to pull out weeds and foreign plants, and so keep the seed clean. Let the clover get ripe, but not so as to shell out too freely before cutting, and handle as little as possible. Pitch up into cocks from the swath and draw in from the cocks in tight wagons. If tough the cocks may be turned over from the bottom a half hour before drawing to shelter. House on a tight floor and thresh out at the first opportunity after the straw has dried out enough to thresh well.—*F. E. Emery, Agriculturist, N. C. Experiment Station.*

CRIMSON CLOVER SEED DISTRIBUTED IN 1893.

The Experiment Station having on hand last year (in 1893) Crimson clover seed which had been grown on the experiment farm, offered through the press of the State to distribute to applicants who would pay transportation charges and would make careful trial of same, enough seed to plant ⅓ acre. There were 1586 persons who applied for the seed, far more than the Station could supply, unfortunately. Indeed a quantity of seed had to be purchased to send as many as was supplied. The first 426 names received were sent the seed. To others full explanation was given as well as at what points the seed could be procured. Replies regarding the test are now coming in and tend to show that wide-spread information has been given in regard to this most valuable forage crop, and much interest has been created in its cultivation.

EXPERIENCES WITH CRIMSON CLOVER.

Just now the Experiment Station is receiving a lot of varied, but interesting information in relation to growing this plant from the farmers to whom seed was distributed last year. Brief directions for every step in growth of the crop were sent with the seed and the call for this information contains specific inquiries as to the various processes which help in studying the effect of preparation of soil in different sections of the State.

That the crop has been found all the Station claimed for it so far, by some farmers is shown in the following report from Vance county:

"Grown on stiff red land in very good condition. Broken with two-horse plow and harrowed with a Gayle harrow. Harrowed the seed in with same implement, October 4th, or 5th, '93. The amount of seed used was 3 pounds cleaned, and it was put on ⅓ of an acre. No fertilizer was used except a dressing of tobacco stems after the clover came up. The clover started well, and continued to grow off well until injured by the March freeze. It has not been grazed but is now being fed green on the soiling system. I think it a splendid feed and will sow several acres this fall if I can get the seed. Think it would be better sown in August or September. I send herewith a specimen which I think is about an average stalk, as it is very uniform and very thick."

The specimen was 26 inches long; the head 2 inches. ⅓ of the piece or 1-9 acre like it should produce seed enough for 5 or 10 acres, or enough if clean, to bring $10.—*F. E. Emery, Agriculturist, N. C. Experiment Station.*

*CLOVER SEED CLEANED AND IN THE CHAFF.

As farmers sometimes wish to purchase clover seed in the chaff, or sow home-grown clover seed without hulling it, the relative value of the seed in these conditions should be understood. Examination of several samples of such seed at the N. C. Experiment Station gives the following results:

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*Miscellaneous B. No. 96, p. 80.

One hundred seeds of red clover in the hull weigh 0.40 gram. The hulls of 100 seed weigh 0.10 gram. The weight of the hulls is ¼ or 25 per cent. of the total weight of unhulled seed. Out of 100 apparent seeds in hull 28 seeds had no germ. Out of a weighed sample of unhulled seeds ¼ the weight was chaff, dirt and weed seeds. In a sample of choice cleaned clover seed we expect to find the viability of seed 95 per cent. Real worth 90.25 per cent. Assuming that in the unhulled sample as great a per cent. of true seeds will germinate as in the sample of choice cleaned seed, we calculate the real worth of this sample as 38.85 per cent. Therefore, in purchasing clover seed in the hull the price should never exceed 40 per cent. of the price of choice hulled seed.—*Gerald McCarthy*, *Botanist N. C. Experiment Station.*

*SOWING CRIMSON CLOVER ON WEEDY LAND.

We have a piece of strong land on a river bank on which there is a very rank growth of weeds. We wish to know your idea of growing annual clover on this land; what preparation should be given and how should the seed be sown.

Corinth, N. C. T. R. P.

(Answered by F. E. Emery, Agriculturist North Carolina Experiment Station.)

If it were not for seeding with the weed seeds you might sow the clover among the seeds broadcast, if the soil is light, and save working the soil.

It will be best to mow the weeds or roll down with a heavy roller a few days in advance of plowing in order to let them partially dry out, and not endanger sowing the land by turning down a great mass of green matter, fermenting in it. Plow well, harrow smooth, sow clover seed broadcast at the rate of fifteen, eighteen or twenty pounds per acre of clean seed, or forty to fifty of chaff per acre. Then drag with a light brush, smoothing harrow, or a plank with a chain attached to both ends and the singletree, so the plank will cover nearly its whole length on the ground. Watch your field, so if seed germinates and is killed by hot weather or insects, you can re-harrow and re-seed.

CRIMSON CLOVER IN 1894.

(A crop of seed $44.61 per acre.)

It is worth while to spread the fact to every farmer that this clover can and will bring dollars to him if he will but grow it.

This crop starts and grows to full maturity and dies between August and the following June. It will start among corn, cotton, or other crops, and need not interfere with the crop for the latter part of the season in which it is sown. When the summer crop is gone, crimson clover takes the soil and, provided it is not too poor, covers it with verdure and increases its fertility while preventing the unsightly washing which frequently occurs without its presence. It only holds the ground for a short time in spring against other crops. If grazed, no delay need be experienced in plowing for early crops, but we would plow all other ground first, as the later this is left the more good it will do stock and land, and the better it will be for the following crop.

If it is made into hay the last of April will see it harvested and the weather will be propitious for hay-making. Indeed, it may well be questioned if it would not be better, for a cotton crop, to have the land in this clover for hay to cut at the time when cotton has usually hardly started in sickly yellow growth, and then turn the land at once and plant the cotton. The roots and stubble will have mellowed the soil and added a rich supply of plant food to push the cotton crop and save a heavy bill for fertilizers. If the crop is late it will doubtless make up the time in more rapid growth, and if it is not quite so far advanced when bolls begin to rot some years in August, it may be as well for the crop. At any rate corn can be planted after crimson clover has been cut for hay or seed, and will find its best development after such a crop.

Now is the time to purchase seed and start to growing this valuable crop. Seed is cheaper than for years before. We would advise those who start to at least save their own seed.

To show some of the possibilities in this crop, a statement is appended of the crop grown on the Experiment Station farm in 1894. This is only what any farmer may equal or exceed, but it shows a profitable use of land for the winter months

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*Miscellaneous bulletin No. 96, p. 75.

Of four acres in clover 2½ were harvested in good order while 1½ acres were storm-beaten when ripe. The yield of seed in hulls on the unhurt portion was 1,487 pounds per acre, valued at 3 cents per pound, a total of $44.61 per acre. On the storm-beaten portion the yield was 581 pounds per acre with a value of $17.43 per acre. This straw has been fed just as though it were prime hay, and teams have worked as usual on it with usual grain food. Corn crop on the land is now better because clover has been grown there. After the clover was cut off, the land plowed well, although elsewhere it was rather too dry to plow. The soil was darker colored than before and harrowed easily to a fine seed bed. We could but consider this soil permanently improved.

A great quantity of seed has been grown in Delaware this year and growers are advertising it for sale at very moderate rates. F. E. Emery, Agriculturist, North Carolina Experiment Station.

Error in Report of Crimson Clover Seed Yield for 1894.

A recent press article gave the crop of seed for this year grown at the Experiment farm at $44.61 per acre When this statement was made a portion of the field recently added, was unintentionally omitted from the calculation of the yield. We hasten to make the correction. This increased area would reduce the value of seed to $31.86 per acre. However, if the straw were included, the total value would be about as first reported.

The crop of unhulled seed in 1893 was 1,956 pounds per acre, which at the low price realized this year, would amount to $58.68 per acre, or $18.07 per acre more than the crop for 1894 as first reported.

The loss by weather-beating amounted to $14.43, which is enough to emphasize the necessity of employing every means possible to save the crop in good weather. On this point the Experiment Station expects to have a seasonable article for next spring before the seed is ripe.—F. E. Emery, Agriculturist, N. C. Experiment Station.

II. CRIMSON CLOVER AMONG NORTH CAROLINA FARMERS.

In ths spring of 1893, the Station harvested a crop of crimson clover seed from 1⅜ acres. Except what was used for seed this crop was distributed to as large number of farmers who made application for it and agreed to pay freight on the same. The crop was sent out in 10 and 5 pound lots in chaff. Later, several bushels of cleaned seed were purchased and distributed in two-pound lots. The seed was exhausted before one-third of the applicants were supplied. In the following spring an Information Bulletin (No. 4) was sent out to the addresses to which seed had been sent. There were 430 of these. Eighty-one replies have been received, and these have been tabulated and furnish the basis for the following:

It may be well to note that 19 out of every 100 to whom seeds were sent have reported.

Of these 81 reporting, six failed to get the seed sent; 50 report having received seed in chaff, 22 clean seed, and three do not specify. The following amounts are reported as having been received: One 30 pounds, two 20 pounds, one 15 pounds, twenty 10 pounds, one 8 pounds, thirteen 5 pounds, one 4 pounds, one 1 bushel, eight chaff, amount not specified, three 2½ pounds, one 1 quart, two three pounds, ten 2 pounds, two one pound.

Those who report more seed than was sent to one individual, either by accident or agreement, had and reported on the seed intended for two or more farmers.

QUESTIONS ASKED.

The questions asked of each man to whom seed was sent were as follows:

1. (*a*) When did you receive the seed?
  (*b*) Was it in chaff or cleaned?
  (*c*) How many pounds?
2. (*a*) What was the character of the land on which this seed was sown?
  (*b*) What was its condition and what preparation was made for seed?
  (*c*) On what date was seed sown?
  (*d*) Was it harrowed, brushed, rolled, or either, after sowing?
  (*e*) What was the area sown?
  (*f*) What fertilizer, if any, was used, and how much?
3. (*a*) Did the clover start well? Has it continued to grow well?
  (*b*) If not, what do you think stopped it?
  (*c*) Have you grazed the plot? If so, how much?
4. If made into hay, please report how much hay was realized from the plot.
5. If it was saved for seed, thresh as soon as dry and report as early as threshed how much seed in chaff you secured by following the directions which were sent with the seed.
6. What do you think of this clover? General remarks.
7. Fill out this blank and return as soon as possible, so you will not forget it, and we can have your data for use with other matter like it.

SUMMARY OF REPLIES.

Taking the replies up *seriatim*, most of them indicate that the seed was promptly delivered, though a few lots were delayed and some two or three lost. As noted above, a few used seed intended for several farmers. As to the chaff, or cleaned seed, it was expected some light might be thrown on which would prove best in farmers' hands—cleaned seed or seed in chaff. Answers on this point will be considered under several heads, thus: Of the number reporting from cleaned seed received, 82 per cent. report that the clover started well regardless of time sown, kind of land, or other conditions. Similarly, from chaff sown, 76 per cent. of replies were that the seed started well; 12 per cent. reported adversely for various reasons, and 6 per cent. of replies were indeterminate on this point. These percentages must be regarded as very favorable for a new crop in unfamiliar hands. The replies are so various as to kind of soil, that it is not feasible to put them in percentages. They vary from stiff red clay to "nothing but sand," and the many successes are well distributed among the various grades, whilst the few failures were also distributed from sand, upland, to mica clay, some sand, and on to stiff red clay. One man says: "It will not do on red clay hills; maybe on bottom lands it will succeed." It has succeeded, in the majority of cases, on all kinds of lands, as reported by those gentlemen who have so kindly complied with the Station inquiries by filling and returning the blanks sent out to them.

Under the inquiry as to condition and preparation, part reported condition good; others reported on condition and plowing and harrowing; while others left out condition of land and confined report to the work done in preparing seed-bed. It appears that at least half the reporters plowed the land, while many others found it only necessary to harrow it. In a few cases the condition of soil, and its preparation, are not given, while in most of the cases the preparation was well done. The clover was left on the surface, brushed, or rolled, and harrowed in. In five cases out of seven, where definite information is given where seed was sown, it grew well without covering by any of the means named; where brushed in, thirteen out of fifteen cases started to grow well; where rolled, eight out of ten cases; and where harrowed in, there were four, perhaps five, in thirty-two which did not start well, for some cause. At least five out of six did well.

On the kind of fertilizer used: A few report bone, ashes; eight, some form of commercial manure; twenty-four, stable manure—three of whom report failure, from Alamance, McDowell and Polk counties, two from September seeding, the other not specified, and on apparently good land, well prepared; twenty-nine report no manure used, and of these only two were failures, and one of these followed clay peas on red clay, and the ground was not harrowed.*

The reporter ascribes the failure to not having harrowed in the seed, but dry weather was mostly responsible, as in wet weather these seeds do hold when thus sown, and on some moist fields they are commonly sown that way. One failure was said to be from a freshet soon after sowing, and the others were nearly all ascribed to dry weather soon after the seed were sown.

Fifteen reporters had grazed the plot of crimson clover from a "very little" to "continually" and a "great deal." Some began to graze in October, some in January and February, and one from Onslow county reported having grazed "all winter."

There were very few reports as to amount of crop harvested. Only two gave definite amounts. These were 600 pounds hay from 20 pounds chaff on one-fourth acre—1 and 1-5 tons per acre: from 2 pounds clean seed on one-eighth acre, which yielded 200 pounds hay from one-half and 45 pounds stripped seed from the other half. This was at the rate of 1 and 3-5 tons of hay or 720 pounds of seed in the hulls—about 6 bushels cleaned—besides the straw, which can be plowed in and becomes a valuable manure, or it can be used for hay, and is quite valuable for such use.

The general remarks were almost all favorable to this clover, though some prefer red clover. The heavy freeze of the last of March, 1894, did much damage to the plots, as 31 reports from 14 counties mention the freeze as having done harm to the crop. These counties are: Alamance, 3; Alexander, 1: Anson, 1; Cabarrus, 11; Durham, 2; Guilford, 3; Iredell, 2; Lenoir, 2; Mecklenburg, 5; Moore, 1; Onslow; Vance, 4; Warren, 1; Wake, 4. A few reports gave favorable comparisons of crimson clover compared with white and red clovers after the March freeze. The crimson clover was injured very much less and grew up well afterwards.

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*The Station Agriculturist has sown seed of crimson clover among peavines broadcast and in rows on red clay loam and sandy situations, and watched the development of the germination of the seed by dew and showers, and has seen the radicles dry up in the hot, dry September weather before they could effect an entrance into the encrusted soil of the clay, or penetrate deep enough into the looser dry sand to secure food and water.

REPORTED FAILURES.

The reported failures have been more carefully examined than the successes. They are few, and if the causes can be avoided, no great losses need be incurred and the danger of loss may be reduced to almost nothing, except an occasional re-seeeding:

a The first failure reported was from sowing seed on the surface among peavines, which was followed by dry weather. Sowing after peavines should be done in the beginning of Dog Days, when there promises to be showers frequent enough to start the young plants. There must not be too dense shade from the peavines, else there will be danger of failure. Very heavy vines should be mown for hay and the seed sown on stubble, after which a harrow may be safely used.

b The second failure was probably a lack of sufficient "stand" to cover the ground, due to dry weather soon after sowing, as no other fault can be found from the report, which was made when the clover was in bloom, 31 inches tall. This reporter says: "It did not start well," and "has not grown." "Have not gathered seed." "Just in bloom, 31 inches high." "It is not much, unless it gets better." But he qualifies this by observing that the land may not suit this clover.

c The third failure was ascribed to dry weather soon after the seed was sown in September. The little which grew did well.

d Fourth failure was apparently from same cause. "Did not come up well. Scattered plants have done well. Neighbors have good plants from purchased seed."

e Also the fifth is reported not to have started well and to have been injured by drought in April and May. The latter, doubtless, due to having been sown late in November. Should have been cut for hay in April in the eastern location, if started by October and not grazed. The dry weather of April would then suit the hay-making.

f The sixth and seventh failures are obvious and need no comment. In these cases the clover seed was sown in November with wheat.

h The eighth was due to freshet, which probably washed away the seed.

i The ninth failure was from Rowan county. The seed was put on good, well prepared, well manured land and was harrowed in. Failure must have been due to *too deep* covering, or hot suns when coming up. This reporter mentions a good piece in Cabarrus county, not otherwise heard from.

The reports which have been reviewed to secure the above notes on crimson clover, came from the following counties: Alexander, Bladen, Buncombe, Cabarrus, Chatham, Edgecombe, Franklin, Granville, Henderson, Johnston, Martin, Onslow, Orange, Pasquotank, Pender, Pitt, Polk, Robeson, Union and Wilson, one each. Anson, Burke, Davie, Halifax, Iredell, Lenoir, McDowell, Moore, Richmond, Rowan, Sampson, two each. Alamance and Warren, three each. Durham and Guilford, four each. Mecklenburg, seven. Vance, eight, and Wake nine.

Although less than half the counties are covered by the reports, they came from nearly all the sections from the east up into the mountains, and indicate that this crop can be successfully grown all over the State.

CONCLUSIONS GENERALLY FAVORABLE.

The Station has advised previous to this, and continues to advise early seeding. There is a better chance to secure a stand of clover, and if one seeding is followed by such dry hot weather as to cause a failue there will be time to reseed the land. The early sown crop may be grazed, and will be ready for hay earlier than a late sown crop which requires favorable winter weather, or a late spring in order to mature well.

There are many words of praise and commendation for this crop from different parts of the State for grazing, for cutting to feed green and for hay. Our own digestion experiments have proven the hay from crimson clover, when well made as was the case in the digested hay to be richer in digestible food than any other clover which had then been subjected to experiment in that line. It is, however, as a seed crop, and a soil improver that we would urge its growth on a large scale. Crimson clover seeds freely. It is capable of adding materially to the incomes of the farmers of every county and at the same time to be helping to increase the fertility of the farms if grown extensively enough to warrant the purchase of hullers to clean the seed for sale. To improve land, this clover is probably next to the cow-pea in value, and should follow the cow-pea and not be used on poor land until the cow-pea has begun an improvement which this crop can be used to continue. It is being grown regularly at the Experiment Farm. At Biltmore this spring we saw a very heavy crop of it being fed to the Jersey cows green, and hay was being made of it. The crop is worthy of the careful attention of every farmer in North Carolina.

Little care and no cultivation after sowing is needed to grow this crop. It grows from fall to April or May, and may succeed a corn crop and leave the ground in season for corn to be grown on the same land as regularly as if it were left bare between the crops of corn. It can be grown the same in cotton fields if grazed off instead of making hay or seed which could not be harvested from among the cotton stalks. Apiarists will find this clover the delight of their colonies, and can greatly extend the season for its blooming by judiciously grazing plantations of crimson clover. We dare not say all that might be said for this crop; but will be content to finish this paper with some notes for those who have no experience with it.

GENERAL HINTS.

The seed is for sale by all leading seedsmen in the Eastern and Southern States. The time to sow this seed is from last of July to December. The later sowing can give satisfactory results only when followed by very mild winter, or late wet spring. The Station has scored its best successes with July and August seeding. It advises preparation of the soil and light covering, though some growers near by, only sow it broadcast in stubble land and give it no further attention, until it is ready to be grazed, local climate and kind of soil determines this point. Mown for hay, or cut for seed, crimson clover *without a nurse crop* will probably be fit to graze as early, or earlier, than any other clover. It will be in a stage to be made into hay by April or early in May as the seed will be ripe during the last half of May. If cut *early* for hay a light seed crop can be taken in June from good land. When made into hay, cut it early for several good reasons.

A clover seed-huller is necessary to clean the seed, and one of these machines is capable of threshing 100 to 150 bushels of seed per day, and cleaning it ready for market at one operation. This is the only extra machine needed, as the seed can be cut by mower or reaper and should be hauled in wagons covered with canvas, directly to the thresher, or stored in places where the shattered seed can be saved. The huller costs too much to be afforded by any but those who have very large areas under cultivation, unless by co-operation, a number of farmers in a town, or county, can agree to buy one together. The cost will be $400 to $550, and for suitable power to run and move it if portable, or traction engine perhaps, $500 to $700 more.

We are credibly informed that the farmers of Delaware, in the center of the seed-growing belt, have purchased from one to two dozen new hullers per year, and may have exceeded the higher figures since our information was obtained.

III. SERIOUS LOSSES FROM FEEDING OVER-RIPE CRIMSON CLOVER HAY.

Under the head "Crimson Clover Hair Balls," F. V. Coville (U. S. Dept. of Agric., Division of Botany, circ. 8, pp. 4, figs. 3), has called attention to death among horses from eating over-ripe crimson clover hay. We have not seen the circular, but a brief review of it is given in Experiment Station Record, Vol. VIII, No. 7, p. 623.

The following contains some North Carolina experience with over-ripe crimson clover hay, first published in THE BULLETIN as per request:

CRIMSON CLOVER FOR HORSES.

DEAR SIR:—Find enclosed a deposit from a horse which has been fed on annual or crimson clover for about thirty days. He is now sick, and I am doctoring him for same. It was about two and a half inches in diameter. Please analyze and give information accordingly. H. B. H., JR.

Afton, N. C.

DEAR SIR:—I send you to-day a ball that was taken from the intestine of a fine mare, about eight inches back of the stomach. This was the one which caused death, as there was mortification at this point. There were three other balls in the stomach.

This mare had been fed only on crimson clover hay and corn. Will you please examine it and write me the cause and a remedy? Also publish it in THE MONTHLY BULLETIN. J. L. A.

Glenview, N. C.

ANSWERS BY FRANK E. EMERY, AGRICULTURIST NORTH CAROLINA EXPERIMENT STATION.

The ball received seems to be a mass of the calyx-teeth, and the hairs surrounding the same, which you may find at the outer end of a clover blossom. When the seed is nearly, or quite ripe, these become somewhat stiff, and have a tendency to form into masses.

Sometime ago the United States Department of Agriculture issued a bulletin, warning against the use of over-ripe crimson clover hay for horses and mules, because of the danger of death from the balls, such as you have found.

At this Experiment Farm there has been considerable chaff and straw fed, also hay, but the hay has been cut too early to have any dangerous stiffness in the calyx-teeth, and the stiff calyx-teeth surrounding the ripe seed has been removed from the chaff and straw which has been fed. Another cause for immunity from disease, when straw and chaff have been fed, must have been in the method of feeding. Corn silage has usually been fed twice daily, and the straw or chaff only once, at night, when the animals had abundant time for mastication, while the previous day's feed must have been carried along in the stomach and intestine by the mass of succulent silage, so far that no mass from two or more feeds ever could accumulate. This method of feeding, then, should commend itself to owners and feeders of horses and mules. In over six years' experience feeding silage to three animals, nearly as long as any silage has been on hand to feed, no mule or horse has lost a day's time by any kind of sickness, and there has been only two times when a trace of sickness could have been caused by food.

One mule has on one or two occasions exhibited symptoms of colic from greedily taking more than his share from the feed which he shared in common with his mate.

1. If crimson clover gets over-ripe make it into seed to be sown.
2. Well cleaned straw and chaff are fairly free from dangerous calyx-teeth.
3. Feed the dangerous hay, if at all, with about alternate feeds of green forage.
4. Be very careful to cut hay early enough to be free from danger.

IV. EARLY AND RECENT INTRODUCTIONS OF CRIMSON CLOVER INTO NORTH CAROLINA.

Very recently, during the past summer, an advertiser in agricultural papers has been offering crimson clover seed in North Carolina as below noted. The letters relating to this have appeared in the paper in which we saw the advertisement of the seed and the commentary was accepted for THE BULLETIN for November, 1897.

CRIMSON CLOVER.

Correspondence of the Progressive Farmer.

Crimson clover is a native of Italy and other parts of Southern Europe. It was first introduced in this country several years ago by the late Dr. Havadine, a florist of Delaware. Being a great lover of flowers, he was attracted to this plant by its beauty, which is hardly exceeded by the finest flower that adorns yard or garden. The beautiful deep green which may be seen all through the winter, when not entirely covered with snow, grows deeper and brighter as spring advances, until early in May, when the flowers appear and the field changes from a deep green to a brilliant crimson, making a sight to behold and to remember. At first its value as a forage plant was not understood, and as a soil restorer it was unknown, and the progress of the plant at first was rather slow. Everyone admired its beauty, and numerous plots were grown for ornamental purposes, but years elapsed before farmers awoke to its value as a regular rotation crop. Crimson clover is now successfully grown in all parts of the Union. It is good for hay; yields two to three tons per acre. It is valuable for seed, which it produces in large quantity; makes a good fall and winter pasture and is a good bee plant; the honey is very white and of excellent quality, but its greatest value lies in its ability to store up plant food, and at the same time sends down its deep feeding roots far in the subsoil to gather and bring to the surface elements of fertility that would be otherwise lost. Crimson clover is an annual, and must be sown in its proper season; this extends from the first of July until the last of September. One peck of seed are usually sown to the acre.

If any of the readers of the *Progressive Farmer* would like to give this clover a trial, I will send them a trial package of seed free by mail if they will send me ten cents in stamps to pay postage. I would recommend sowing the seed in July or August if ground is ready. Every flower garden should have a bed of crimson clover, as the plant is strikingly beautiful. CARL B. CLINE.

Columbus, Ohio.

[From the Progressive Farmer of September 21, 1897.]

Correspondence of the Progressive Farmer.

Noticing the letter of Mr. Cline, I was struck by his offer to send crimson clover seed into North Carolina as a novelty crop farmers ought to be acquainted with. That Dr. Haverdine may have made an independent importation of this seed no one will deny, but that he should be accredited with having started this crop in the United States is absurd. "There is nothing new under the sun," and this clover may have had a dozen independent introductions before this writer, Mr. Cline, or any other reader of the *Progressive Farmer* was born. Here at Raleigh we have an unassuming farmer who made an independent introduction of crimson clover into this section by bringing a little seed in his trunk from England about twenty years ago. It has been grown by him and others ever since, but has never been as extensively grown anywhere in America as in and around Delaware within the last eight years. There the crop is properly valued as a land improver and as a cash crop for seed to sell.

Here in North Carolina crimson clover was known for at least forty years, as State Geologist Emmons makes some very accurate observations on it, though falling into the error that it required a cooler climate than is found in Eastern counties. It was perhaps grown in his time by sowing in spring. If readers respond to Mr. Cline's offer of seed as farmers did to another from the Experiment Station a few years ago his seed will soon be exhausted. About $140 worth of seed went off like hot cakes, and then only about one-third of the names listed were supplied. A notice had to be given that supply was exhausted.

Readers of the *Progressive Farmer* will do much better and credit themselves to buy seed of some growers and enter into the cultivation of this clover on a scale large enough to afford a cloverseed huller in every county or town, and make cloverseed, instead of cotton or tobacco, one of the cash crops. It will pay in increase of other crops in rotation. It will pay in itself. It will pay in the increased number of cattle, sheep and swine which can be better kept on the farm, and each animal made to sell for more money than formerly without crimson clover.

FRANK E. EMERY.

[From the November BULLETIN.]

CRIMSON CLOVER SEED.

Who has tried Mr. Cline's offer of free crimson clover seeds for ten cents, to pay the postage? Don't all speak at once, but some one tell us how many ounces of seed he got for ten cents.

Remember, this is a farm crop, of which hundreds of bushels of seed may be grown on any large farm, and thousands of bushels ought to be grown and used for seed to improve "worn out" soils. How much fertility for ten cents from Mr. Cline?

One Man Has Tried It.—There came one day through the West Raleigh postoffice a little package to R. E. L. Crenshaw. It was from Carl B. Cline, Columbus, Ohio. It was crimson clover seed. It is in my office, where the editor can see it. There are two little packets, such as the Delaware farmers used to mail out sample packages of seed, which they raise to sell to their customers. If you write one of these farmers for quotation of prices and for a sample of seed, he will send you as large a sample and expect you to buy a bushel or two; or, say 100 pounds, at about five or six cents per pound. Some even send you directions for preparation of land, time to sow and what to do with the crop, or nearly this amount of information, with the seed when you purchase it from them. Not so with Mr. Cline. He is selling a novelty for which he must have a round price. The seed in the two packets weighed 25 and 26 grams. It takes 28.35 grams to make an ounce. Suppose when freshly put up and rather scantily weighed (so the added paper would bring the parcel under the United States postal law at two ounces), suppose, we say, it had been two ounces of seed. Ten cents, less two cents for postage, leaves eight cents for seed. The difference in weight can well pay for paper and clerk hire to put up and lick on the stamps, and Mr. Cline gets EIGHT CENTS FOR TWO OUNCES OF CRIMSON CLOVER SEED!

This is four cents an ounce, sixty-four cents a pound, and $38.40 per bushel. Don't it pay to advertise in the right way? Six-cents-a-pound seed raised to sixty-four cents! And this for a crop which ought to be as commonly grown as is corn and seed for home use and for sale as common as it is in Delaware.

Several years ago some one advertised a new coffee berry for seed—could be cultivated anywhere, made a good substitute for coffee, yielded well, etc., etc., all of which was true of the soja or soy-bean, the kind of seed which was being advertised for sale under the new name of coffee berry at twenty-five cents per pound. I believe the advertiser requested money or stamps for postage. He should have planted his first few crops and come out after this later illustrious seedsman has paved the way for greater wealth under legitimate names.

FRANK E. EMERY,
Agriculturist N. C. Agricultural Exp. Station.

State Geologist Emmons, in his second report, addressed "To His Excellency, Thomas Bragg, Governor of North Carolina," (date of letter of transmittal, March 1, 1858), said of this clover:

"CRIMSON CLOVER (*trifolium incarnatum.*—In some parts of this country this clover would no doubt succeed. It, however, requires a climate rather cooler and moister than that of the eastern counties. But in the mountainous section of the Southern States it can hardly fail of being received with favor. The advantages arising from its culture are, it may be sown after potatoes are secured and produce a spring crop which which will be earlier by eight or ten days than lucerne or red clover. It produces two good crops in one year. It is, however, an annual, and it requires as much care to insure success as the red clover. For soiling cattle it is well adapted, in consequence of its early growth. If cut for hay, it should be gathered as soon as it is in flower. The seed may be obtained from the second crop. As a general rule, where red clover succeeds, it may also be expected that crimson clover will succeed also."

Miscellaneous Farm Bulletin.

I. VARIETY TEST OF COW PEAS.
II. GERMINATION TEST OF WHEAT.
III. A VARIETY TEST OF COTTON.
IV. SOME EXPERIMENTS WITH POTATOES.

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THE NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION
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NORTH CAROLINA COLLEGE OF AGRICULTURE AND MECHANIC ARTS,

RALEIGH, N. C.

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The Station is glad to receive any inquiries on agricultural subjects. *Address all communications to the Agricultural Experiment Station, and not to individuals.* They will be referred to the members of the Station staff most competent to answer them.

MISCELLANEOUS FARM BULLETIN.

F. E. EMERY, Agriculturist.

I. A SMALL VARIETY TEST OF COW PEAS.

A small plat of land was to be planted to the cow-pea in July, 1896, and a variety test was planned and put on it. The plat was comprised in one-sixth acre. The rows were put far enough apart to give 30 rows across the piece and six rows of each of four varieties were planted. Then two rows of common black peas and four rows of common clay peas were planted. The clay peas had been selected out as "dark" and "light" clay, but have been counted as clay, dropping the distinction for this trial. In working the adjoining plat, two-thirds of one row of clay peas was plowed out. These peas were planted July 3d after the ground was plowed on June 29.

On September 22d the following notes were taken as there seemed to be differences enough in the ripening of the peas to be indicated in this manner.

1. Queen of Carolina, nearly all ripe and leaves falling. Some leaves and fruit still green.

2. Foliage darker, *i. e.*, later than that of No. 1, but there are fewer green pods.

3. *Unknown* or Innominate. Color and degree of ripeness about as in No. 1.

4. *Clay Bank.* Still green; heaviest vines on the whole plat; very few, if any, fully ripe pods.

5. *Black Cow-pea.* All ripe and the foliage all has fallen.

6. *Clay Cow-pea.* Rather heavy vines with but few ripe pods. Foliage beginning to turn. The portion of clay pea plat planted as "dark" clay seemed a trifle more advanced than did the "light" clay portion.

YIELDS PER PLATS OF EQUAL AREAS.

No. of Plat.	Name of Variety.	Peas per Plat Corrected Yields. Pounds.	Pods and Chaff per Plat. (Not Revised).	Peas per Acre. Bushels.	Pods and Chaff per Acre. Pounds.
1	Queen of Carolina	20.8125	7.06	10.41	....
2	Red Troy (Ripper)	38.75	13.63	19.38	....
3	Unknown Pea, Innominate, Wood's Wonderful.	43.6875	12.375	21.84	....
4	Clay Pea	19.25	2.94?	9.63	....
5	Black Cow-pea	18.375*	12.94*	9.19	....
6	Clay Cow-pea	32.775*	11.70*	16.39	....

*Multiplied to raise yields to same areas as other plats.

The earliest ripening pea was No. 5 with Nos. 2, 1, and a few days later, and in this order.

No. 4 was the latest pea and No. 6 next latest.

No. 4 grows the heaviest vines, while No. 6 grew nearly as many.

No. 3 gave the heaviest yield of dry peas, with No. 2 a close second. The Clay pea 11.16 bushels per acre was but little more than half as prolific as was No. 3. Scarcely below the Clay was the Queen of Carolina 10.4 bushels per acre, and No. 4 Clay Bank with 9.63 bushels per acre, while the Black pea gave the lowest yield 9.19 bushels. The yield from this plat was doubtless materially reduced by some game chickens which paid their respects to it for several days. There being but two rows of these peas, only a few missing would materially affect the results.

II. TEST OF EFFECT OF CHEMICAL MANURE AND COTTON-SEED MEAL GERMINATION OF WHEAT.

At different times complaints have come to this Station that grain did not do well when drilled with certain manures and in many cases it was found that cotton-seed meal was used as the source of the nitrogen in the manures used. In some field tests with tobacco the experiments were practically ruined by something in the manure or in the manner and time of its application.

It is believed that the oily character of the meal interferes materially with the rising of water in the soil by capillarity, and that the injury done in the cases referred to above, resulted from the arrest of capillary moisture by the recent application of manure containing much cotton-seed meal.

A practical test on wheat was planned to find whether the meal alone would much affect the germination. A number of plats of three rows each were laid off and manured in drills opened by hand, the seed was then sown and covered, except in case of six plats, on which the manure was put on top of the covered rows. These six plats, 17 to 22, were duplicates, in every other respect, of plats 11 to 16. The plats 11, 12 and 13 were manured with a mixture of acid phosphate and kainit in equal parts by weight, in three rates of ½, 1 and 1½ pounds, and one pound of cotton-seed meal for each plat. Plats 14, 15 and 16 were manured with cotton-seed meal alone at the rate of one pound per plat. This was put under whilst as noted the duplicates were manured on the surface after the seed had been covered. The mineral manures put on these plats 11, 12, and 13 also 17, 18 and 19 were the same and applied in equal amounts with what was put on plats 8, 9 and 10 without cotton-seed meal. Plats 1 and 30 had no manure at all. Plats 2, 3 and 4 had acid phosphate alone, at the rates of ½, 1 and 1½ pounds. Plats 5, 6 and 7 had kainit alone at the same rates which were equivalent to 105, 210 and 315 pounds per acre.

Plats 23, 24 and 25 had the same amounts of mixed kainit and acid phosphate and six ounces each of sodium nitrate per plat. Plat 26 was given the same with more sodium nitrate, and plat 27 was given sodium nitrate alone, in the same amount as allowed for plat 26 or 131¼ pounds per acre. Plats 28 and 29 were duplicates respectively of plats Nos. 6 and 3.

After the planting which was all done in one day, November 28th, the weather was very favorable to those combinations which were thought to be unfavorable to the germination of the wheat. A soaking rain set in the next morning during which 1.92 inches of water fell and this was followed by a freeze and snow during the first few days of December. The melted snow amounted to 0.17 inch more water. The cool weather greatly retarded germination but wheat came up well during the latter part of December. The wheat appeared a little earlier and grew faster on plats 1, 2, 6, 7, 8, 9, 10, 11 and 17. On plats 3 and 4 at the time of making the notes the wheat was about half as tall as on those previously named, and about medium growth between these extremes, had been attained on plats 18 to 30 inclusive. On No. 12 the growth was slower, and on No. 13 and 14 slower yet, while on Nos. 15 and 16 the growth was about the same as on Nos. 13 and 14. A difference in appearance existed here all winter, there were fewer plants and these were of smaller growth than on other plats. Meadow larks probably took some young plants out of plat 1, and possibly plat 2, about this time. These plats bordered a grass plat and being near the buildings the birds did not venture out from cover far, or long enough to reach other plats, or to do much injury.

After vegetation was probably complete a count of the plants in each row should indicate in a general way whether there had been any retardation of germination and growth from the effect of the cotton-seed meal on the seed wheat. Raw weather with soil too wet to go on delayed and somewhat restricted the count to fewer plats than would otherwise have been counted.

The plants on the most important plats were counted January 23d by A. H. Oliver, B. S., then a senior student assisting in farm work.

	Plat 1.	*Plat 30.*	*Plat 14.*	*Plat 15.*	*Plat 16.*	*Plat 20.*	*Plat 21.*	*Plat 22.*
Row 1	1317.	1191.	787.	678.	704.	1229.	1206.	1150.
Row 2	1234.	1169.	876.	730.	625.	1153.	1119.	1119.
Row 3	1190.	1272.	666.	889.	611.	1185.	1101.	1045.
Per cent. of stand counting one plant for each seed sown.	59.4	57.7	37.0	36.5	30.8	56.6	54.4	52.6

There were two and one-fourth ounces of seed used in each row. A count of four lots weighed out gave an average of 2125 kernels of wheat exclusive of cracked and broken grains, so it may be just to assume 2100 kernels of sound wheat per row. From this number as a base the percentage of stand was calculated on the plats counted. All others appeared to differ so little in the number and growth that no count was attempted on other plats. If plats 1 and 30 represent normal germination and strength of plants up to the time of the count, the plats which had received cotton-seed meal on the surface can not be said to have deviated far enough to be noticed. There was on these plats a stand of 96.8, 92.9 and 90 per cent. respectively, of the average on plats 1 and 30, which differed by 3 per cent. in total stand of plants. The plats which received cotton-seed meal under the wheat suffered to a considerable extent. The stand was only 37, 36.5 and 30.8 per cent., or based on the average of plats 1 and 30, 62.3 and 52.6 per cent. of normal which seems to indicate an injurious effect from the cotton-seed meal.

A trial with cabbage and rape has been begun and others will follow to make sure whether the meal does harm or not with other families of plants, and if so, to point out a way to prevent it.

This is probably indicated by the growth on plats with cotton-seed meal spread on top of the soil. Broadcasting while preparing the seed-bed or ahead of the drill will perhaps be a preventive of loss from this cause.

III. A VARIETY TEST OF COTTON, 1893.

A variety test of cotton was made on a plat which had the previous season produced a heavy growth of sorghum. The five-eighths acre of land received eight two-horse loads of stable manure in March. This was plowed in and the land bedded up and opened and 2½ pounds per plat of acid phosphate was put in and the seed planted as given in table below. The acid Phosphate used was a little under 60 pounds per acre.

TABLE I.—SHOWS VARIETIES GROWN, SOURCE OF SEED, DATES OF PLANTING AND VEGETATION, STAND OF PLANTS AT HARVEST.

No. of Plat.	No. of Row.	NAME OF VARIETY.	Rows Planted.	Source of Seed.	Date of Planting, April 25th.	Date of First Vegetation.	No. of Plants at Harvest.
1	1 2	Aflfi Egyptian.	2	U. S. D. of A.	April 25.	May 2.	535
2	3 4	Bamia.	2	"	"	"	599
3	5	The Allen.	1	"	"	"	213
4	6	Allen's Silk.	1	Capt. Ardery's Variety Test.	"	"	284
5	7 8	Alexander's Okra Leaf.	2	"	"	"	588
6	9 and 10	Geo. W. Truitt's Imp.	1½	A. D. & S. Co.	"	"	
	N-half 10	" " "	½	Capt. Ardrey's Variety Test.	"	"	338
7	11 12	Jeff Welborn's Pet.	2	A. D. & S. Co,	"	"	289
8	13 14	Peerless.	2	Capt. Ardrey's Variety Test.	"	"	418
9	15 16	Peterkin (Pure).	2	Dr. Thomas' Variety Test.	"	May 4.	497
10	17 18	Shine's Early Prolific.	2	T. W. Wood & Son.	"	"	508
11	19 20	Tennessee Gold Dust.	2	Capt. Ardrey's Variety Test.	"	"	496
12	21 22	King's No. 1.	2	T. J. King.	"	"	549
13	23 24	King's No. 2.	2	T. J. King.	"	"	496
14	25 26	Matthew's Long Staple.	1–2 pcs	J.A.Matthews.	"	"	441

A count of the plants in each row was made, but no corrections have been made to perfect stand. It is preferred to make weights and averages on actual yields, because, where there were open spaces in rows caused by missing plants more sunshine and more room to branch out would give the varieties which presented the poorest stand an advantage which they would be given for no merit but rather thus gained, perhaps, from defective seed. The number of plants per plat at harvest time has been given above as last column in Table I. The greater room afforded for branching partly compensates for loss of stand. The figures of Table II are based on what was actually realized in harvest with no attempt to proportion to perfect stand.

TABLE II.—SHOWING WEIGHT OF SEED COTTON PICKED, WEIGHT GINNED, WITH LOSS IN PER CENT. FROM PICKING TO GINNING, AND WEIGHTS OF SEED AND LINT OBTAINED.

No. of Plat as in Table I.	Weight of Seed Cotton Picked.		Weight of Seed Cotton Ginned.		Per Cent. of Loss from Picking to Ginning.	Weight of Seed from Gin.		Weight of Lint from Gin.		Per Cent. of Seed.	Per Cent. of Lint.	Per Cent. of Motes, Sand, Waste, etc.	Pounds of Seed per acre.		Pounds of Lint per acre.	
	lbs.	ozs.	lbs.	ozs.		lbs.	ozs.	lbs.	ozs.				lbs.	ozs.	lbs.	ozs.
1	37	11	....	....	?	16	9	8	4	66.75	33.25	?	376	4	187	5
2	35	9	33	4*	6.50	22	8	10	12	67.67	32.33	?	511	4	244	3
3	38	10	36	00	10.03	24	12	10	15	68.75	30.38	0.85	1125	0	497	1
4	49	8	41	12	15.67	28	8	14	11	68.56	31.44	0.30	1301	1	596	6
5	81	4½	71	1	12.57	46	14	23	4	65.96	32.72	1.32	1065	3	528	5
6	77	2	71	8	7.29	47	3	24	2½	66.00	33.79	0.22	1072	5	549	1
7	66	4	63	15	3.49	37	10	21	1	59.43	33.27	7.30	863	6	483	5
8	89	13	71	3	20.74	47	00	23	6	66.78	33.21	0.01	1080	4	537	3
9	82	13	76	9	7.53	49	1	26	14	64.08	35.10	0.82	1115	0	610	8
10	89	9	83	7	6.84	55	11	27	6	66.74	32.88	0.38	1265	6	623	5
11	83	8	79	8	4.79	54	2	24	15	68.08	31.37	0.55	1230	1	566	8
12	87	14	86	2	1.99	55	13	29	9	64.80	34.11	1.09	1268	4	667	7
13	91	3	84	3	7.64	55	6	28	6	65.78	33.70	0.52	1258	6	644	8
14	92	14	70	11	23.89	49	3	21	12	69.58	30.77	0.35	1239	0	547	9
Averages..........			....	....	9.92	....	....	....	....	66.35	32.81	1.14	1055	2	520	4

*Some mistake in weight and the of seed and lint obtained is used here.

Notes on growth June 9th.—The varieties on plats 1 and 2 were Egyptian cotton.

1. *Afifi.* Plants smallest and nearly dead where ground is wet.

2. *Bamia.* Growth vigorous as on any plat except at north end where water stands some after rain.

The Allen. Growth vigorous as on any plat at north end where water stands some after rain.

Allen's Silk. Growth vigorous as on any plat except at north end where water stands some after rain.

Alexander's Okra Leaf. Growth nearly as large as any variety.

Truitt's Improved. Stand poor; growth smaller than in Alexander's Okra Leaf.

Jeff. Welborn's Pet. Stand and growth not the best.*

Peerless. Stand and growth about medium.

Peterkin. Stand and growth about equal to the best.

Shine's Early Prolific. Stand and growth about equal to the best.

Tennessee Gold Dust. Stand and growth about equal to the best.

King's. No 1. Stand and growth equal to the best.

King's No. 2. Stand and growth equal to the best.

Matthew's Long Staple. Stand and growth equal to the best.

Cold weather has kept cotton rather poor and small.

July 4th. Saw first bloom to-day on Matthew's Long Staple. Have not hunted for more.

July 10th. In examining the cotton to-day it appears that most blooms are on the west side and from fallen blooms that King's Nos. 1 and 2, Matthews Long Staple, Alexander's Okra Leaf, Peterkin and Tennessee Gold Dust were first to bloom and in about this order.

This cannot be considered fully as an indication of earliness in the varieties named as the ground rises toward the west and shades from clay to sandy or gravely which was better drained and grew its crop faster when there was a plenty of rather cool water in the soil. On the east side there was far too much water around part of the plats 1, 2, and 3 on which Afifi, Bamia and Allen cottons were grown.

Calendar of Operations.—May 12th, cultivated cotton with Iron Age cultivator.

May 18th and 19th, chopped part of cotton and cultivated it 19th.

May 22d and 23rd, transplanted cotton to better stand and hoed it by hand. The transplanting consisted in moving out a spade full of earth where a plant was wanted and taking a like amount up with a plant in it where one was crowding and setting the latter in the hole made by first removal of soil. It is quickly and successfully done.

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*The promoters of Limbless cotton claim in the advertisements (seen in the *Biblical Recorder* just as this is sent to press) that it is identical with this variety.

June 10th, plowed with sweep.
June 20th, plowed with sweep.
June 27th, thinned and scraped.
July 10th, split middles with cultivator.
July 11th, barred off with sweep.

Picked out Sept. 9th, Sept. 20th and 21st, Oct. 7th and 10th, Oct. 27th and 28th, Nov. 18th, and Dec. 20th and 21st.

Observations and Conclusions.—September 9th, first picking on 9 varieties. The three highest yields from first picking were: King's No. 1, 20$\frac{3}{16}$ pounds; King's No. 2, 17$\frac{9}{16}$ pounds; Tennessee Gold Dust, 10$\frac{5}{16}$ pounds, which was nearly double the amount from all the other varieties combined.

The cotton was picked out very carefully, going over the plats six times, viz: September 9th, September 20th and 21st, October 10th and October 27th and 28th, November 18th, and December 20th and 21st.

These varieties have been grown together before with exception of those from U. S. Department of Agriculture and Mr. Matthews.* Notes taken when growing indicate there has been some mixing of seed, or of pollen. Probably mixed by bees and other insects.

July 26th, lightning scorched about one rod on both rows of Plats 8, 9, 10, and injured to a less extent, adjacent rows of Plats 7 and 11.

August 8th, very few bolls have been shed during recent wet weather and less from Egyptian varieties than from others. The area damaged by lightning is dying and will not make much, if any crop.

There were blooms on all the plats at the time of last picking, October 26th.

The highest per cent. of lint came from Peterkin, King's No. 1 and Shine's Early Prolific.

The highest yields of lint came from King's No. 1, King's No. 2, Shine's Early Prolific and Peterkin, with over 600 pounds of lint per acre.

The five varieties on plats 10 to 14 yielded very nearly like amounts of seed, the highest being 1268 and the lowest 1230 pounds per acre.

The average yield per acre was 520.4 pounds of lint and 1055.2 pounds of seed.

IV. SOME EXPERIMENTS WITH POTATOES.

1. *Deep vs. Shallow Culture.*—Potatoes were planted March 5, 1892, in the bottom of a furrow made by a one-mule plow run twice. Area used, one-twentieth acre. Ground leveled in covering four inches deep.

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*Seed received from Jas. A. Matthews, Holly Springs, Miss.

Opposed to this, the same area was planted with identical amounts of seed and equally spaced, but planted on the surface and pressed down level, then covered with a hoe. The ground was left very uneven by digging to cover seed 2 to 3 inches deep.

The rows were 33 inches apart and seed placed two feet apart in the rows. Early Beauty of Hebron potatoes were used for seed.

The amount of seed used per acre was on an average 18 bushels. The method of seeding will be found under (3) as this was one of a combination experiment.

There were six rows of potatoes planted in each plat. The one-twentieth acre was comprised in 65 hills of the rows which were filled out at the lower end at the same rate of seeding. The same treatment was accorded this end as that given the whole plat, it was not planted until March 15th. When harvested row 3 showed a missing hill, and row 7 three missing hills, which were replaced by the same number taken at the end of the measured plat. The stand was complete in the other rows.

Spraying.—The Colorado Potato Beetle (Doryphora decemlineata) strongly attacked the potatoes. They were sprayed four times. The first time a shower washed the Paris Green off from the foliage. The second spraying was done as soon as the weather cleared and was very efficacious in removing beetles and larva. There were unhatched eggs, and some beetles which escaped. The third spraying nearly cleared up the second lot of larva, and a week later a fourth spraying was given for a few scattered lots left, the tops were in a very vigorous thrifty condition and were in strong contrast with some garden plats in the neighborhood which had not been sprayed and which were fairly stripped of foliage.

July 1st, tops all green and thrifty. The different amounts of seed are showing very plainly in the amount of tops. Some hills dug into show a *new growth* to be starting from the effect of recent wet weather. The potatoes were considered ready to dig on July 19th, but crates had not arrived to receive them and digging was deferred until the 24th.

When the tubers were dug it was found that the second growth, which had undoubtedly added very largely to the yield, had made a considerable portion of the crop unsalable because of the large number of prongs which had grown out on the first growth. The division of tubers was then made into merchantable ; merchantable size, but rough and small. The tubers were counted. The following table gives the number and weight of tubers of each class into which they were sorted by rows :

TABLE I.

PLAT 1.

No. of Row.	NO. OF TUBERS.			Total Number of Tubers.	Weight of Merchant-able.		Weight of Rough.		Weight of Small.		Total Weight of Tubers.	
	Mer-cha't'ble	Mer-cha't'ble size but rough.	Small.		lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
1	335	151	800	1286	73	8	26	4	43	2	142	14
2	294	188	433	915	76	1	34	4	22	9	132	14
3	220	136	518	874	50	13	33	8	31	5	115	10
4	254	194	620	1068	54	7	43	8	34	4	132	3
5	297	149	583	1029	61	4	40	14	28	0	130	2
6	190	185	438	813	44	12	39	5	24	9	108	10
	1590	1003	3392	5985	360	13	217	11	183	13	762	5
PLAT 2.												
7	164	232	644	1040	46	6	41	13	47	1	135	4
8	265	205	486	956	48	10	37	2	26	9	112	5
9	165	186	510	861	39	1½	33	13	22	2	95	½
10	269	192	625	1086	54	2	47	3	32	7	133	12
11	280	150	400	830	53	12	31	11	22	12	108	3
12	167	158	385	710	37	9	34	6	25	12	97	11
	1310	1123	3050	5483	279	8	225	6	176	11	671	9

The yields from these two twentieth-acre plats were derived from a perfect stand on each. The different rates of seeding were equal for these plats. Therefore the differences of yield may be regarded as due to the different mode of planting and culture, and the variable degrees of warmth and moisture to which these differences subjected the growing plants. Both lots suffered from the pronged growths, but the difference in this respect was in favor of the deep planting.

	lbs.	oz.	
Yield from deep planted and level culture plat....	762	5,	254.1 bushels per acre.
Yield from planted shallow and hilled plat.......	671	9,	223.9 bushels per acre.
Gain by deep level culture...	90	12,	30.25 bushels per acre.

2. *Early vs. Late Planting.*—On March 31st an adjoining strip of land, which had been worked at the same time as the plats planted early, was planted with the same kind of seed and at the same rates of seeding per acre. The pieces of seed for each row were in all cases made as even in size as possible, so that every piece was almost an even aliquot part of the seed for the row.

The late-planted plat was given deep culture. This plat was held back in order to note the effect on growth due to late planting.

At first cultivation of this plat, before it had been vegetated, the cultivator was accidentally run over these rows and some of the seed dug up.

The cultivations were made light, and as often as any sign of crusting of the surface showed the need.

On May 10th the cultivator was run through the twelve rows planted early, and the first six rows for deep culture were hand hoed, but not "hilled." A single turn-plow was run, and the soil turned up to the rows, and hand-hoes smoothed up the work for shallow-planted plat.

Nothing was done at this time to the late-planted portion, where scarcely more than half of a stand of plants were left.

The unfortunate treatment of this plat nearly lost the whole value of it, but the number of hills planted and harvested were known, and the yields actually harvested are here raised in the proportion of the harvested to perfect stand of "hills" on the plat. The area was one-seventeenth acre planted in six rows, duplicating the method of planting, culture, and rate of seeding given to plat I.

TABLE II.

PLAT 3.

No. of Plat.	NO. OF TUBERS CALCULATED FROM THE HARVEST.				WEIGHTS CALCULATED FROM THE HARVEST.					
	Merchantable	Rough.	Small.	Total.	Merchantable Pounds.	Rough. Pounds.	Small. Pounds.	Total Weight. Pounds.	Plat Y'lds for Different rates of Seeding. Pounds.	Yields per Acre. Bushels.
13	163	182	......	......	28.93	42.47	36.81	108.21		
16	167	76	603	846	33.86	16.47	30.36	80.69	183.90	160.6
14	213	106	730	949	36.15	19.19	32.55	88.69		
17	109	142	727	978	17.57	31.94	41.19	90.70	179.39	152.5
15	78	160	667	895	16.19	24.57	35.19	75.95		
18	153	148	419	720	24.22	26.69	19.19	70.10	146.05	124.1
	883	814	3146	4852	156.92	161.33	195.29	514.34		145.7

The yields calculated out to acre areas show a striking decrease in yield from those of the plat planted earlier and grown by the same method of cultivation and treated in the same way, except not cultivated out of the ground one time.

Yield per acre for plat planted late	145.7 bushels per acre.
Yield per acre for plat planted early	254.1 bushels per acre.
Difference	108.4 bushels per acre.

The difference is mainly due to time of planting. Potatoes grow best in a moist, rather cool soil. Very early spring weather suits them here, and they should be planted as soon as danger of freezing passes in order to be nearly grown before the warm, dry weather, so pleasing to cotton growers, sets in.

The average weight of all the tubers on the late-planted plat was 1.69 ounces: merchantable, 2.81 ounces; rough, 3.17 ounces; and small, 0.806 ounce.

3. *Different Rates of Seeding.*—Seed was selected about equally from small and large tubers. These were divided to put sixty-five pieces weighing six, nine and twelve pounds in adjacent rows. Then these three were duplicated in the next three on each of the plats. The six pounds per row amounted to twelve bushels per acre; the nine pounds to eighteen bushels, and the twelve pounds per row to twenty-four bushels of seed per acre.

The rows 1 and 4, on plat 1, and 7 and 10, plat 2, and 13 and 16, plat 3, are the ones which received the heavier seeding. Rows 2 and 5, 8 and 11, and 14 and 17, are those which received the middle rate of eighteen bushels of seed per acre, while the remaining rows, 3–6, 9–12, and 15–18, received the lowest rate of seed, 12 bushels per acre.

The yields of tubers from each of the three plats may be shown as in the following table, calculated to acre proportions.

TABLE III.—SHOWING YIELDS PER ACRE AT DIFFERENT RATES OF SEEDING.

	24 Bushels Seed per acre.	18 Bushels Seed per acre.	12 Bushels Seed per acre.
	y'ld in bu.	y'ld in bu.	y'ld in bu.
Plat 1: 2 Rows deep planted with level culture	275.		
2 “ “ “ “ “ “		263.	
2 “ “ “ “ “ “			224.25
Plat 2: 2 Rows surface planted with hill culture	269.		
2 “ “ “ “ “ “		220.5	
2 “ “ “ “ “ “			190.72
Plat 3: 2 Rows late deep planted with level culture	160.6		
2 “ “ “ “ “ “ “		152.5	
2 “ “ “ “ “ “ “			124.1

Reading this table left to right shows the effect of decreased amount of seed when the controlable conditions were all like, but the one of seed. Reading down the column the effect of shallow planting and hill culture, and also late planting, is seen. It may be reconstructed to show how many bushels might have been gained per acre by an addition of six bushels and twelve bushels of seed per acre from yields which appear in the last column.

TABLE IV.—SHOWING GAIN IN RATE OF YIELDS BY ADDITIONS TO SEED PLANTED.

	Gain in Yield from Addition of 12 Bu. Seed.	Gain in Yield from Addition of 6 Bu. Seed.
Plat 1. Planted early deep	50.75	38.75
Plat 2. Planted early and shallow	78.98	29.78
Plat 3. Planted late and deep	36.5	28.4

Of course one must understand that to produce a full crop of tubers, plant food must have been shipped in sufficient quantity, so there need be no lack of yield on account of no food material to produce a full crop. The greatest effect may then be expected from the fields which have been planted early, and the seed put in deep, if the soil has been frequently enough stirred to prevent exhausting the water supply by evaporation, and thereby holding down the temperature of the soil to degrees more favorable for the growth of the potatoes.

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A Study of Lettuces.

THE RESULTS OF A VARIETAL TEST OF LETTUCES FOR THE BENEFIT
OF THE LETTUCE GROWERS OF NORTH CAROLINA.

ISSUED BY
THE NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION,
RALEIGH, N. C.

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RALEIGH, N. C.

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A STUDY OF LETTUCES.

W. F. MASSEY, HORTICULTURIST.

The great increase of interest in the cultivation of lettuce as a winter crop in Eastern North Carolina has made it important that the growers should be acquainted with the best varieties for their purpose. Out of the long list of varieties of lettuce found in the catalogues of seedsmen there are really few that are adapted to winter growing in frames or greenhouses. While lettuce is grown here almost entirely in frames covered with plant cloth, we are sure that the growers would consult their own interest by using glass sashes in place of the cloth, and for the very best results. While it is seldom that any artificial heat is required in our climate for the production of lettuce in winter, we have at times winters when a little heat would result in the saving of the crop from serious damage. Hence we believe that as our people get more familiar with the use of glass, there will be found a decided advantage in the use of broad, low, flat-roofed greenhouses with some means for heating them when it is desirable, and with abundant means for ventilation at all other times. The fact that the lettuce shipped from our Eastern section in winter and early spring sells in the market as "Southern Lettuce" at a lower price than the product of the greenhouses of the North, is of itself an indication that there is room for improvement in our culture and handling of the crop. Our growers always ship their lettuce in barrels and it is sold by the barrel. If the product was as good as that from the greenhouses North, and was shipped in handy boxes, it would be sold by the dozen heads and would bring a larger price. I know this from practical experience. Years ago I was engaged in growing lettuce extensively at Fortress Monroe, Va., for the Northern market, and always sold my lettuce in New York by the dozen heads, and at prices that would double those our growers consider good when sold by the barrel.

Then, too, there must be a closer study of the demands of the markets where the crop is sold. As a rule I believe that there is more profit in the close-heading cabbage sorts, like the Tennis Ball—than in the loose, curled lettuce like the Simpson or even the Grand Rapids. Of course, where the crop is sold by the barrel the large lettuces like the Grand Rapids and the Black seed Simpson fill up faster, but even then I believe that the price per barrel of the close, heading sorts would be enough higher to make them more profitable. In our experience we have not yet found any lettuce better than a good strain of Black-Seeded Tennis Ball especially for the early or Christmas crop, while for the later crops we believe that some of the Butter varieties are better than the Big Boston, which has always been rather unsatisfactory with us.

Our variety test of lettuces this spring has not been as satisfactory as we could have wished, as we did not have it under the same conditions as would confront the market-growers in winter. This came from the fact that we were unable to get our frames ready in time for the regular winter crop. Hence the test is simply comparative and does not reach the question as to which is really the best for winter use, as our lettuce was heading the last of April. We have, however, learned enough to enable us to make a selection of varieties for further trial under real winter conditions the coming fall, and also to note some sorts that can even now be recommended for trial by our market-growers. One great advantage in the use of glass over the plant cloth is the fact that we can get more crops during the winter and spring than can be had under the cloth, and can get better lettuce. But it is one of the curious facts about the sale of lettuce that, while the crop sold at Christmas and during the winter may bring fair prices, the largest price is generally to be had for the lettuce that comes in the last of March, when every one wants it. In the dead of winter lettuce is sought only by a certain and limited class of buyers, while the spring lettuce is in general demand.

Varieties tested were as follows:

Maule's Improved Hanson.—This is a fine strain of the well known Hanson. It is one of the best for spring use but is not adapted to culture under glass, though used to some extent for that purpose. Makes very large heads and the fringed margins of the leaves make it a handsome variety. Raised many years ago by Col. George Hanson, of Kent Co., Md., from whom it takes its name.

Tilton's White Star.—This is a very early, light green sort, making loose heads of many leaves like the old Oak Leaf. It has been recommended for culture under glass, but we are not inclined to think it will be valuable for this purpose, though worth trying further. It seems well adapted to stand hot weather.

Big Boston.—This sort has been highly recommended and used to a large extent for winter growing, but in our experience there are other sorts far superior. It is late and heads irregularly with us.

Denver Market.—We had two samples of this from different seedsmen. One of the samples did not seem to be a well fixed type, but the other from Mr. Maule, of Philadelphia, is a great improvement on the Grand Rapids, and for those who want the curled sorts it is very promising.

Iceberg.—An immense headed lettuce of the curled India type, which will be valuable for late spring use, as it seems to stand the heat well. It is of lighter color than the Italian Ice lettuce.

Maule's Philadelphia Butter Lettuce.—This is probably the largest of the Butter lettuces, and a very promising sort for the early spring crop, and also for standing the heat later on. Worth trial under glass for the last crop.

Early Prize Head.—This did not prove very early with us. It has the reddish tinge characteristic of the Brown Dutch class, and makes fairly good heads. May be good for the outdoor crop.

Stubborn Seeder.—A very large heading Cabbage or Butter lettuce, which seems to deserve its name, as it holds its heads well in the heat and shows no signs as yet (late May) of running to seed.

Black Seed Simpson.—This is in our experience the very best of the loose curled lettuces of the Silesia group. Makes a very large, loose head or bunch and is very brittle and handsome. A first-class lettuce of the kind and one that forces well.

Green Fringed.—A very handsome lettuce for garnishing, and for standing hot weather in the spring in the open ground, but of no use for forcing in winter.

All the Year Round.—This is a Cabbage lettuce of medium size, which in our experience is one of the earliest to head under glass, and is promising for the Christmas crop along with the Tennis Ball. With us it has headed earlier than any other sort.

Black Seed Tennis Ball.—This we consider the best of all forcing lettuces, because, from its compact growth it can be planted closer than most others, and it heads uniformly and very compact. Boston Market is claimed to be an improvement on it, but we have not found it so.

Boston Curled.—This is the most handsome of all the fringed lettuces for garnishing purposes and for standing heat. Worthless for forcing.

Grand Rapids.—This much praised variety we have not succeeded with well, and so far do not consider it as valuable as the Black Seeded Simpson. Further trial may make a difference in our opinion, but as yet we prefer the Simpson.

Lancaster.—A light yellowish strap-leaf sort similar in growth to the Oak Leaf, which promises to stand the heat well. Would not select it for winter use.

Yellow Seed Butter.—A standard old Butter lettuce, which has done good service in the past, but is now superseded by improved Butter sorts.

San Francisco Market.—This is one of the best of the newer Butter lettuces and we consider it worthy of further trial under glass.

Black Seed Butter.—Earlier than the old Yellow-Seed Butter and better, but there are still better sorts of the class.

California Cream Butter.—In our test this is far the best of all the Butter lettuces and is a very promising sort for winter culture for the early spring crop. It heads remarkably solid and uniformly, and is the best lettuce we have had on the table the past winter. We were fortunate in having this variety both in our winter frames in our home garden and among the later ones of the general test, and can confidently recommend it to our growers as far better than the Big Boston Makes better heads than the Boston and takes less room.

Gold Nugget.—Light yellowish green, of medium size and the earliest of the Butter class. Worthy of further trial.

Philadelphia Early White Cabbage.—A very early sort, which may do well under glass, but runs to seed directly as the weather gets warm.

Early White Seed Boston Market.—A very early and compact header, which can be planted closely, and is good for culture under glass, but we prefer the Black Seed Tennis Ball for the same planting.

Hittinger's Belmont.—Very similar in general character to the Boston Market, but much larger heads. We consider it well worth trying further.

Mignonette and Improved Mignonette.—These are small heading varieties of the Brown Dutch type. Heads quite small, and the improved a little larger than the other, but neither worth growing among the many better lettuces.

Morse and Morse Cabbage.—We have these under two names, neither of which is a true Cabbage lettuce. Both are curled lettuces and the Morse Cabbage seems to make a rather larger head than the Morse. May answer as well as Grand Rapids for those who want a curled lettuce. In fact they are better here than Grand Rapids.

Early Curled Silesia.—The old type, which is now superseded by better curled lettuces, and we see no reason for continuing it and some others in the catalogues.

Onandago.—One of the Brown Dutch type, and inferior in our experience to the old Brown Dutch.

Burpee's Tomhannock.—This is the most handsome of all the Brown Dutch class. Makes fine large heads, and the edges of the leaves are beautifully margined with reddish brown. Quite desirable for outdoor crop.

Henderson's New York.—A fine large heading sort that seems to partake partly of the character of the Curled India and the Butter sorts. It is one of the best for late spring use, as it is very slow in running to seed. Probably a selection from the Deacon.

Italian Ice.—Very large and fine. Darker in color than the Iceberg and of larger size. One of the best of its class.

Paris Self-Folding White Cos.—Cos lettuces as a rule are not popular in this country, as most of them involve too much attention to tying up the heads for blanching. When well grown they are appreciated by critical consumers. This variety seems to be a true self-header and a very fine and promising sort. It will be a long time, however, before there is much demand for Cos lettuce in this country.

Giant White Cos.—This is an immense header and a fine lettuce when properly handled.

Dwarf White Heart Cos.—We can confidently recommend this dwarf Cos to private growers who want a Cos lettuce. It heads uniformly without tying and is really a very fine lettuce.

No. 1851.—A variety of lettuce sent for trial by W. Aster Burpee, of Philadelphia. This is the most peculiarly distinct variety we have seen. The leaves are almost a pure yellow and covered all over with reddish brown spots. Heads small and growth feeble. Interesting as a variety, but hardly of great practical value.

As we have said, our test this spring is but tentative, and the opinions expressed may be changed by future experience. We are sorry that our experience with the Grand Rapids does not confirm the high opinion which is given in nearly every seed catalogue in the country, and some of our growers may have had a different experience with it. But as a rule we believe that the heading sorts will pay the market-grower better than the curled lettuces.

We do not like to make any decided recommendations from this test, but feel that we cannot go amiss in urging our growers to test the California Cream Butter lettuce—an unnecessarily long name by the way—for we believe it will be found superior to the Big Boston for the same season.

If this brief statement of experience will have helped any of our growers we will be abundantly rewarded. We hope by another winter to be better fixed for lettuce growing and invite the lettuce growers of Eastern North Carolina to visit us then and study the varieties for themselves. We hope to have then an object lesson that will save them many dollars in the profits of this crop, which is of such growing importance to North Carolina. We hope to get them into more skillful methods, not only of growing the crop but in marketing it so as to realize higher prices. The Station will, at all times, be ready to answer promptly all letters of inquiry in regard to any crop and its best treatment.

Our full Bulletin on the use of glass in the cultivation of market crops will soon be out, and we wish to get it in the hands of every trucker in the market garden section of the State.

Paris Sugar Loaf, *White Cos.*—Cos lettuces as a rule are not popular in this country, as most of them require too much attention in tying up the heads for blanching. When well grown they are appreciated by special customers, and are sure to prove to be a remunerable crop [illegible] [illegible] [illegible]. It will bear [illegible] [illegible] however, unless there is much demand for Cos lettuce in this section.

Grand Rapids grows best as a forcing lettuce under glass and a fine lettuce when properly handled.

Early Curled Cos.—Grows and blanches excellently. This dwarf Cos [illegible] [illegible] [illegible] a Cos lettuce. It heads [illegible] without tying and is really a very fine lettuce.

Mignonette.—A variety of lettuce sent out by W. Atlee Burpee, of Philadelphia. This is the most peculiarly distinct variety we have seen. The leaves are almost a pure yellow and crimped all over with reddish-brown spots. Rather small and growth rather uninteresting as a variety but [illegible] of great commercial value.

As we have said, our test this spring is but tentative and the opinions expressed may be changed by future experience. Where our character [illegible] with the [illegible] [illegible] does not conform to the high opinion [illegible] [illegible] [illegible] seed catalogue as [illegible], and some of our growers may have had a different experience with it. This is a guide to [illegible] that the dealing with ... pay [illegible] [illegible] [illegible] than the [illegible] lettuces.

We do not like to make any decided recommendations from a single test, and feel that we cannot go amiss in urging our growers to test the California Cream Butter Lettuce as [illegible] [illegible] the same [illegible] [illegible] believe it will be found superior to the [illegible] lettuce for this section.

If this brief statement of [illegible] will have helped any of our growers we will be abundantly rewarded. We hope to continue a [illegible] [illegible] in lettuce growing and [illegible] the lettuce growers of Eastern North Carolina to [illegible] [illegible] and study the varieties for themselves. We hope to have them see more of lettuce that will increase their knowledge of the growth of this crop, which is of such growing importance in North Carolina. We hope to get them into more skillful methods of growing the crop, and in [illegible] it so as to secure higher prices. The Station will, at all times, be ready to answer promptly all letters of inquiry in regard to any crop and its best treatment.

Our fall Bulletin will take up some of the cultivation of market crops, as [illegible] [illegible], and we wish to get it to the hands of every trucker in the eastern garden section of the State.

Digestion Experiments.

TIMOTHY HAY.
TIMOTHY HAY WITH COTTON-SEED MEAL.
CRAB GRASS HAY.

Pasteurization of Milk.

ISSUED BY
THE NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION,
RALEIGH, N. C.

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DIGESTION EXPERIMENTS.

F. E. EMERY, AGRICULTURIST.
B. W. KILGORE, ASSISTANT CHEMIST.

HAY ALONE, AND IN RATIONS WITH COTTON-SEED MEAL.

Previously reported digestion work* has been done with cotton-seed products, ensilage, and rations made from them and on various other forage plants. It seemed desirable to digest Timothy hay, which sells at a high price on the markets of North Carolina cities, and also the native Crab grass hay, and rations of these hays with cotton-seed meal. In the rations of cotton-seed hulls with cotton-seed meal, and of corn silage with cotton-seed meal, there has been an increase of the digestible carbohydrates so much greater than the loss of digestible protein that it should create an additional incentive to feeders to feed well in order to secure this increased amount of digestible food from the coarse fodders, cotton-seed hulls, corn silage, etc., which they would lose if the meal were not added in the ration, but their animals forced to subsist on the coarse food alone, or with inadequate amounts of meal added to it to secure the gain from increased digestibility. One of the questions on which information was sought was whether the digestibility of these hays would follow the same course with relatively increasing amounts of cotton-seed meal fed in rations with each hay that has been found with the other coarse fodders used in previously reported experiments. In this respect there is little or no correspondence between those fodders and the Timothy hay used in these experiments. The hay was less digestible with cotton-seed meal than without it. The composition of foods used in the experiments hereinafter reported are shown in Table I, together with the composition of waste and solid excrement for all the experiments.

The feeding for these experiments was mostly done by R. E. L. Crenshaw, under the immediate direction of the Agriculturist. Collecting was done by him, assisted by Assistant Horticulturist, A. Rhodes, during some absences of the Agriculturist. The analyses were made by Messrs. F. B. Carpenter, C. B. Williams and H. K. Miller, of the Chemical Division under the direction of Mr. Kilgore.

These experiments were all made with young sheep purchased for the purpose. Two stalls were prepared for collections, so they could be opened out to give sheep room to move about during the preliminary feeding and the sheep comfortably confined for saving excrement during the collection periods. Two other stalls of about equal size were prepared, and two sheep were placed in these and fed the same as those which were being used for the digestion experiments. This was to provide a safeguard for the experiment should any accident befall the other sheep in any period. No such trouble occurred, and at the end, sheep Nos. 3 and 4 were used to duplicate the digestions made by sheep Nos. 1 and 2 on crabgrass hay in order not only to have an average of four animals for the digestibility of the hay, but as a means of comparison as to the relative digestive powers between the sheep.

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*Bulletins 80c, 87d, 97 and 118.

These sheep when first stabled were fed on corn silage, morning and noon, with mixed hay at night for a few days; then they were fed the hay to be digested.

The time of year and close confinement during all the hot weather of mid-summer, with no ill effects therefrom, is worthy of note. All four of the animals were turned out in good health after nearly ten months of confinement.

(1.) DIGESTION OF TIMOTHY HAY BY SHEEP NOS. 1 AND 2.

Timothy hay fed: 2¼ pounds per day to each sheep.

Total period on Timothy hay alone 36 days. The sheep were separated and fed individually 24 days. Collection period began July 29th; the first day's collections were not completed and were discarded. Sheep No. 1 was retained an extra day because of a small loss on another occasion for which a day's collection was discarded; the period ended August 9th for sheep No. 2 and August 10th for sheep No. 1. Feces were collected 12 and 11 days. Two days lost by sheep No. 1, and one day by sheep No. 2. Feed and waste was for 12 and 11 days.

	No. 1.	No. 2.	No. 3.	No. 4.
The sheep weighed when these collections began,	69	69 n'rly.	47 n'rly.	65
Average of three weights next after harnesses removed at close of collections	71	70	50	66

The weights were maintained and sheep gained some during the period.

All the analyses of hay, etc., for this and following experiments will be found in Table I, appended to this report. The coefficients of digestibility as worked out in Table No. II, are for dry matter, 51.2 per cent.; ash, 23 per cent.; protein, 33.5 per cent.; fat, 17.6 per cent.; nitrogen-free extract, 58 per cent.; crude fibre, 48 per cent.

Nutritive ratio, 1: 25.1.

(2). Digestion of Timothy Hay and Cotton-seed Meal by Sheep Nos. 1 and 2.

Date of Experiment, August, 1895.

Rations fed: 36 ounces hay, 2¼ ounces cotton-seed meal daily to each sheep. The rations were consumed in the ratio of 15.15 to 1 when calculated on dry matter. Total period 19 days. Feces were collected during the last 10 days.

	No. 1.	No. 2.	No. 3.	No. 4.
Weights of sheep in early part of this period...	71	70	50	66
Weights of sheep Nos. 3 and 4 at close of this period..........			50⅓	66
Nos. 1 and 2 three weights next succeeding collections	74	68⅓		

The weights were maintained. Analyses are included in Table No. 1. The coefficients of digestibility as worked out in Table No. III, are:

	Dry Matter, per cent.	Ash, per cent.	Protein (N×6.25), per cent.	Fat, per cent.	N-Free Extract, per cent.	Crude Fibre, per cent.
For the Ration..	55.3	22.8	50.7	50.1	62.1	48.9
For the Hay....	54.1	22.4	28.4	36.2	62.2	48.9

Nutritive ratio of ration, 1: 12.4; of hay in ration, 1: 33.2.

(3). Digestion of a Second lot of Timothy Hay with Cotton-seed Meal, by Sheep Nos. 1 and 2.

Date of Experiment, August and September, 1895.

Rations fed: 33 ounces per day of hay and 2¾ ounces cotton-seed meal.

Total period 21 days; feces were collected during the last 10 days.

	No. 1.	No. 2.	No. 3.	No. 4.
Weights of sheep early part of period Nos. 1 and 2 and end of last period as above	74	68⅓	50⅓	66
Weights of sheep Nos. 3 and 4 at end of period, Nos. 1 and 2 early part of next..........	81⅔	71	50⅓	71½

Weights of sheep Nos. 1 and 4 were somewhat advanced by more than average amounts of water drank previous to weighing. Slight gain probable.

All analyses are given in Table No. I. Coefficients of digestibility as worked out in Table No. IX, are:

	Dry Matter, per cent.	Ash, per cent.	Protein (N×6.25), per cent.	Fat, per cent.	N-Free Extract, per cent.	Crude Fibre, per cent.
For the Ration..	53.6	21.2	24.9	64.1	59.9	47.2
For the Hay....	52.0	19.9	32.4	53.4	59.8	47.2

Nutritive ratio of ration, 1: 9.9; of hay, 1: 26.3.

(4). DIGESTION OF SECOND LOT TIMOTHY HAY AND COTTON-SEED MEAL BY SHEEP NOS. 1 AND 2.

Date of Experiment, September and October, 1895.

Rations fed: 32 ounces hay, 4 ounces cotton-seed meal daily to each sheep. Total period, 21 days; collection of feces was made during the last 10 days.

	No. 1.	No. 2.	No. 3.	No. 4.
Weights of sheep, taken as above	81⅔	71	50⅓	71½
At end of period, taken as above	76	69⅓	51	70⅔

In consideration of effect of water on weights of sheep, as noted above, we consider the weight fairly maintained. Nine weights immediately following the three which averaged 81⅔, for No. 1 averaged 77 pounds, while the two days before harness was put on he weighed less than this amount, evidently because of drinking less water the evenings before being weighed. All analyses are given in Table No. I. Coefficients of digestibility as worked out in Table No. V, are:

	Dry Matter, per cent.	Ash, per cent.	Protein, (N × 6.25), per cent.	Fat, per cent.	N. Free Extract, per cent.	Crude Fiber, per cent.
For the Ration	48.9	10.4	54.9	61.5	55.0	41.7
For the Hay	45.8	6.2	20.8	43.6	54.5	41.6

Nutritive ratio of ration, 1: 7.7; of hay, 1: 37.

(5). DIGESTION OF TIMOTHY HAY AND COTTON-SEED MEAL BY SHEEP NOS. 1 AND 2.

Date of Experiment, October and November, 1895.

Rations fed: 26 ounces Timothy hay and 6½ ounces cotton-seed meal per day to each of 3 sheep, No. 3, 16 and 4 ounces respectively. Total period, 26 days. Collection period, 15 days. First 5 discarded because sheep wasted a little hay under feet. Collections were saved the last 10 days.

	No. 1.	No. 2.	No. 3.	No. 4.
Weights of sheep as before	76	69⅓	51	70⅔
Weights of Nos. 3 and 4 at end of period, Nos. 1 and 2 beginning of next period	74⅙	66½	50⅙	68⅓

Weights *nearly* maintained, if not quite, except for No. 1 some loss. Weights affected by sheep Nos. 1 and 4 taking less water than usual on evenings before being weighed. All analyses are given in Table No. 1. Coefficients of digestibility as worked out in Table No. VI, are:

	Dry Matter per cent.	Ash, per cent.	Protien, (N×6.25), per cent.	Fat, per cent	N-Free Extract, per cent.	Crude Fiber, per cent.
For the Ration	51.5	*5.7	60.6	74.7	57.3	42.7
For the Hay	45.8	....	3.9	55.4	56.7	42.6

*Only for sheep No. 2. Nutritive ratio of ration, 1: 5.3; of hay, 1: 204.

(6). Digestion of Timothy Hay and Cotton Seed Meal by Sheep Nos. 1 and 2.

Date of Experiment, November, 1895.

Rations fed each of three sheep: 20 ounces hay and 10 ounces cotton-seed meal per day. Sheep No. 3, 14 ounces hay and 7 ounces meal. Total period, 20 days; collection of feces occurred during the last 10 days.

	No. 1.	No. 2.	No. 3.	No. 4.
Weights of sheep, taken as above	74⅙	66½	50⅙	68⅓
Weights of sheep at close of period, taken as above	73	67⅔	50 5-6	67 5-6

Weights maintained. Weight of No. 1, affected as before, by water drank. Ten weights during preliminary period averaged 72.45 pounds. A loss occurred during last collection, or this ration was not quite sufficient to maintain his weight. All analyses are given in Table No. 1. Coefficients of digestibility, as worked out in Table No. VII, are:

	Dry Matter, per cent.	Ash., per cent.	Protein (N×6.25), per cent.	Fat, per cent.	N-Free Extract, per cent.	Crude Fiber, per cent.
For the Ration..	59.1	14.7	71.4	84.9	66.9	39.5
For the Hay....	52.0	6.6	6.3	71.7	68.4	38.9

Nutritive ratio of ration, 1: 3.5; of hay, 1: 74.8.

(7). Digestion of Timothy Hay and Cotton-Seed Meal by Sheep Nos. 1 and 2.

Date of Experiment, November and December, 1896.

Daily rations fed Sheep Nos. 1 and 2: 18 ounces each, hay and meal; No. 3, 13 ounces each, hay and meal; No. 4, 16 ounces each, hay and meal. Total period 24 days; collection of feces was made during last 10 days.

	No. 1.	No. 2.	No. 3.	No. 4.
Weights of sheep, as above, at beginning of period	73	67⅔	50 5-6	67 5-6
Weights of sheep, as above, at end of period	77⅓	73 5-6	53	71 5-6

A decided gain of weight occurred during the period. All analyses are given in Table No. I. Coefficients of digestibility, as worked out in Table No. VIII, are:

	Dry Matter, per cent.	Ash, per cent.	Protein (N×6.25), per cent.	Fat., per cent.	N-Free Extract, per cent.	Crude Fiber, per cent.
For the Ration..	61.4	27.4	75.6	88.6	68.8	27.8
For the Hay..	49.2	20.8	....	83.0	73.0	24.8

Nutritive ratio of ration, 1: 2.34.

(8). DIGESTION OF SECOND LOT TIMOTHY HAY ALONE BY SHEEP NOS. 1 AND 2.

Date of Experiment, December, 1895, and January, 1896.

Rations fed: 36 ounces of Timothy hay daily to sheep Nos. 1 and 2, 32 ounces to sheep No. 4, and 26 ounces to Sheep No. 3. Total period 21 days; collection of feces was made during the last 10 days.

	No. 1.	No. 2.	No. 3.	No. 4.
Weights of sheep, taken as above, at the beginning of the period	77⅓	73 5-6	53	71 5-6
Weights of sheep at close of period, taken as before....................................	73 5-6	72½	50⅔	70 5-6

Weights not maintained as at beginning of period. All analyses are given in Table No. I. Coefficient of digestibility as worked out in Table No. IX, are: Dry matter, 54.2 per cent.; Ash., 28.7 per cent; Protein (N × 6.25), 35.1 per cent; Fat (Ether extract), 49.2 per cent.; N-free extract, 66.1 per cent.; Crude Fiber, 42.2 per cent.

Nutritive ratio of hay, 1: 25.3.

(9). DIGESTION OF TIMOTHY HAY AND UNDECARTICATED SUNFLOWER SEED MEAL ATTEMPTED.

Date of Experiment, January, 1896.

Rations offered: Sheep Nos. 1 and 2, 32 ounces Timothy hay and 2 ounces Sunflower-seed meal.
Sheep No. 3, 24 ounces Timothy hay and 1½ ounces Sunflower-seed meal.
Sheep No. 4, 26 ounces Timothy hay and 1¾ ounces Sunflower-seed meal.

Total period 22 days, divided as follows: Meal offered the second and eight succeeding days and none consumed. Meal offered two days and hay withheld. No meal consumed during either portion of this period. Hay fed alone rest of period. The seed was raised in 1894 by several parties and was, after some delays, gathered together and put through the cotton oil mill to express the oil. The meal fed was probably too old or perhaps the seed was damaged in curing. At least sheep would not eat it.

(10). DIGESTION OF CRABGRASS HAY BY 4 SHEEP, NOS. 1 AND 2.

Date of Experiment, April, 1896.

Rations fed: Sheep No. 1, 32 ounces; Sheep No. 2, 36 ounces; Sheep No. 3, 26 ounces; Sheep No. 4, 26 ounces per day. Total period, 30 days. For first experiment, 20 days; second experiment, 10 days more for collection period for Sheep Nos. 3 and 4.

Weights of Sheep	No. 1	and No. 2.	No. 3	and No. 4.
April 1–3, average of 3 weights..........	83	84⅔	60⅔	77⅔
April 20–21, average of 2 weights........	76½	82½	....	....
April 18–19–20, average of weight........	....	....	62⅙	76⅔
April 28–29–30, average of weights.......	69⅔*	72½*	....	....

Weights of two sheep not maintained, and the other two about maintained. All analyses are given in Table No. 1. Coefficients of digestibility as worked out in Table No. X, are:

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*Sheared April 21; fleece 3⅛ and 2 9-16 lbs. respectively.

	Dry Matter, per cent.	Ash, per cent.	Protein, (N×6.25), per cent.	Fat (Ether Extract), per cent.	N-Free Extract, per cent.	Crude Fiber, per cent.
Average for 4 sheep .	50.7	44.4	....	42.6	51.0	58.4

Nutritive ratio, 1: 99.5.

TABLE A.—Digestibility of Timothy Hay Fed Alone and with Different Proportions of Cotton-seed Meal.

Number of Experiment.		Total Dry Matter.	Ash.	Protein (N×6.25).	Fat (Ether Extract).	N-Free Extract.	Crude Fiber.
1	Average per cent. digested from Timothy hay when fed alone..	51.2	23.0	33.5	17.6	58.0	48.0
2	Average per cent. digested from Timothy hay fed with cotton-seed meal when fed in proportion of 16 hay to 1 meal with some waste, assumed to be all hay, where the ratio eaten was 15.15 to 1 on dry matter....................	54.1	22.4	28.4	36.2	62.2	48.9
3	Average per cent. digested from second lot of Timothy hay fed with cotton-seed meal in the proportion of 12 to 1 with dry matter consumed at the rate of 11.7 in hay to 1 in meal...	52.0	19.9	32.4	53.4	59.8	47.2
4	Average per cent. digested from Timothy hay fed with cotton-seed meal in the proportion of 8 to 1 with dry matter consumed at the rate of 7.77 to 1 in hay and meal........	45.8	6.2	20.8	43.6	54.5	41.6
5	Average per cent. digested from Timothy hay fed with cotton-seed meal in the proportion of 4 hay to 1 of meal with dry matter consumed at the rate of 3.88 in hay to 1 in meal...	45.8	.....	3.9	55.4	56.7	42.6
6	Average per cent. digested from Timothy hay fed with cotton-seed meal in the proportion of 2 hay to 1 meal with dry matter consumed at the rate of 1.8 in hay to 1 in meal....	52.0	6.6	6.3	71.7	68.4	38.9
7	Average per cent. digested from Timothy hay fed with cotton-seed meal in the proportion of 1 of hay to 1 of meal with dry matter consumed at the rate of .98 in hay to 1 in meal..	49.2	20.8	.....	83.00	73.0	24.8
	Average per cent. digested from second lot of Timothy hay when fed alone.	54.2	28.7	.....	49.2	66.1	42.2
	Average per cent. digested from two lots Timothy hay when fed alone	52.7	25.9	34.3	33.4	62.10	45.1
	Average per cent. digested from crabgrass hay when fed alone. Average of four trials with four difierent sheep...	50.7	4.44	......	42.6	51.	58.4

TABLE I.—Showing Percentage Composition of Foods. Waste and Solid Excrement.

Analysis No.		Water.	Dry Matter.	DRY MATTER CONTAINS					
				Ash.	Protein (N×6.25).	Albuminoids (Alb. N ×6.25).	Fat (Ether Extract).	N-Free Extract.	Crude Fiber.
656	Timothy hay	9.35	90.65	3.86	5.66	4.42	2.11	55.92	32.45
663	Waste, timothy hay, Sheep No. 1	12.48	87.50	5.59	5.71	5.13	2.62	53.02	33.06
664	Waste, timothy hay, Sheep No. 2	12.20	87.80	5.80	6.67	6.21	2.41	52.06	33.06
661	Solid excrement, Sheep No. 1	66.90	33.10	6.15	8.08	6.94	3.46	48.65	33.66
662	Solid excrement, Sheep No. 2	67.16	32.84	5.51	7.52	7.46	3.53	48.06	35.38
660	Cotton-seed meal	9.76	90.24	6.93	47.79	47.17	10.48	29.30	5.50
671	Waste, Sheep No. 1	15.30	84.70	7.75	7.58	5.66	2.07	48.49	34.11
672	Waste, Sheep No. 2	13.35	86.65	4.81	5.91	5.72	2.23	52.50	34.55
669	Solid excrement, Sheep No. 1	69.90	30.10	6.37	9.02	8.06	3.12	47.18	34.31
670	Solid excrement, Sheep No. 2	72.49	27.51	6.97	9.39	8.54	2.81	45.59	35.24
675	Waste, Sheep No. 1, third experiment	17.56	82.45	5.44	10.06	8.78	2.59	49.28	32.63
676	Waste, Sheep No. 2, third experiment	14.55	85.45	4.92	7.74	6.33	1.99	50.51	34.84
673	Solid excrement, Sheep No. 1, third experiment	69.02	30.98	7.59	8.92	8.11	2.27	44.73	36.49
674	Solid excrement, Sheep No. 2, third experiment	76.21	23.79	8.46	9.05	8.20	2.07	43.48	36.94
677	Timothy hay fed, third and later experiments	10.88	89.12	4.56	5.99	5.26	2.14	52.79	34.52
678	Waste, Sheep No. 1, fourth experiment	20.29	79.71	9.50	17.82	11.60	3.46	42.03	27.19
679	Waste, Sheep No. 2, fourth experiment	11.83	88.17	5.50	8.00	6.56	2.47	50.53	33.50
680	Solid excrement, Sheep No. 1, fourth experiment	71.94	28.06	8.42	9.47	8.31	2.35	44.08	35.68
681	Solid excrement, Sheep No. 2, fourth experiment	77.81	22.19	8.43	9.40	8.00	2.30	44.30	35.57
685	Waste, Sheep No. 1, fifth experiment	25.67	74.33	24.35	31.25	28.50	6.88	26.64	10.85
686	Waste, Sheep No. 2, fifth experiment	15.04	84.96	4.98	7.91	7.41	2.65	53.19	31.27
683	Solid excrement, Sheep No. 1, fifth experiment	77.39	23.61	10.60	11.94	10.32	1.64	42.05	33.77
684	Solid excrement, Sheep No. 2, fifth experiment	79.59	20.41	9.78	11.69	10.72	2.37	42.36	33.80
689	Waste, Sheep No. 1, sixth experiment	20.00	80.00	11.07	35.78	32.41	8.11	31.04	14.00
690	Waste, Sheep No. 2, sixth experiment	9.53	90.47	11.02	37.50	34.02	8.36	30.51	12.61
687	Solid excrement, Sheep No. 1, sixth experiment	72.18	27.82	11.06	14.28	12.75	1.91	36.40	36.35
688	Solid excrement, Sheep No. 2, sixth experiment	77.78	22.22	11.20	13.69	11.94	1.75	36.31	37.05

TAALE I.—Showing Percentage Composition of Foods, Waste and Solid Excrement.—Continued.

Analysis No.		Water.	Dry Matter.	DRY MATTER CONTAINS					
				Ash.	Protein (N×6.25).	Albuminoids (Alb. N ×6.25).	Fat (Ether Extract).	N-Free Extract.	Crude Fiber.
700	Hay waste, Sheep No. 1, seventh experiment..........	7.15	92.85	5.50	15.85	13.78	3.44	41.47	33.74
699	Meal waste, Sheep No. 1, seventh experiment.........	6.66	93.34	7.88	50.13	46.07	10.25	22.80	8.94
701	Waste, Sheep No. 2, seventh experiment.	20.39	79.61	10.72	43.79	40.03	7.89	24.13	13.47
697	Solid excrement, Sheep No. 1, seventh experiment ...	65.78	34.22	11.05	17.44	14.69	1.82	31.05	38.64
698	Solid excrement, Sheep No. 2, seventh experiment.....	65.81	34.19	10.54	16.72	13.84	1.93	35.26	35.55
704	Waste, Sheep No. 1, eighth experiment	14.39	85.61	4.80	6.50	5.92	2.23	44.39	42.08
705	Waste, Sheep No 2, eighth experiment....	12.30	87.70	4.65	5.78	5.13	3.49	45.14	40.94
702	Solid excrement, Sheep No. 1, eighth experiment	67.24	32.76	7.19	8.52	7.06	2.37	40.28	41.64
703	Solid excrement, Sheep No. 2, eighth experiment	73.65	26.35	6.93	8.35	7.44	2.26	39.62	42.84
706	Solid excrement, Sheep No. 1, ninth experiment.......	67.58	32.42	8.40	10.06	8.50	2.45	46.21	32.88
707	Solid excrement, Sheep No. 2, ninth experiment	81.16	18.84	9.10	10.06	9.06	2.46	44.25	34.13
708	Waste, crab-grass hay, Sheep No. 1, ninth experiment..	11.51	88.49	5.63	6.26	5.60	2.58	46.90	38.63
709	Waste, crab-grass hay, Sheep No. 2, ninth experiment..	11.11	88.89	5.00	5.16	4.47	2.17	46.35	41.32
710	Total solid excrement, Sheep No. 3, tenth experiment..	63.46	36.54	7.02	9.13	8.19	2.14	42.88	38.83
711	Total solid excrement, Sheep No. 4, tenth experiment..	61.28	38.72	7.26	10.28	9.56	2.25	47.24	32.97
712	Waste, crab-grass hay, Sheep No. 3, tenth experiment..	12.39	87.61	4.75	4.51	3.75	1.99	47.65	41.10
713	Waste, crab-grass hay, Sheep No. 4, tenth experiment..	10.99	89.01	5.97	6.29	5 44	2.47	44.34	40.93
715	Crab-grass hay, first and second experiments..........	13.02	86.98	6.41	5.00	4.03	2.18	45.42	40.99

TABLE II.—Showing Nutrients Consumed and Excreted in Grams with Percentage Digested.

SHEEP NO. 1.

No. of Analysis.		Total Amount.	Dry Matter.	DRY MATTER CONTAINS					
				Ash.	Protein (N×6.25).	Albuminoids (Alb. N × 6.25).	Fat (Ether Extract).	N-free Extract.	Crude Fiber.
656	Timothy hay fed in 12 days	12247.2	11102.1	428.54	628.38	490.71	234.25	6208.29	3602.63
663	Waste, timothy hay, 12 days	1407.5	1231.8	68.86	70.34	63.19	32.27	653.10	407.23
	Total consumed	10839.7	9870.3	359.68	558.04	427.52	201.98	5555.19	3195.40
661	Total solid excrement, 10 days	11401.0	3773.7	232.08	304.91	261.89	130.57	1835.91	1270.23
	Total excrement per day	1140.1	377.4	23.21	30.49	26.19	13.06	183.59	127.02
	Total digested per day	....	445.1	6.76	16.01	9.44	3.77	279.34	139.26
	Per cent. digested	....	54.12	22.56	34.43	26.49	22.40	60.34	52.30

SHEEP NO. 2.

No. of Analysis.		Total Amount.	Dry Matter.	Ash.	Protein (N×6.25).	Albuminoids (Alb. N × 6.25).	Fat (Ether Extract).	N-free Extract.	Crude Fiber.
656	Timothy hay fed in 11 days	11226.6	10176.9	392.83	576.01	449.82	214.73	5690 92	3302.40
664	Waste, timothy hay in 11 days	788.	691.9	40 13	46.15	42.97	16.67	360.20	228.74
	Total consumed	10438.6	9485.0	352.70	529.86	406.85	198.06	5330.72	3073.66
	Consumed per day	948.96	862.27	32.06	48.17	36.99	18.01	484.61	279.42
762	Total solid excrements in 10 days	13564.	4454.4	245.44	334.97	332.30	157.24	2140.78	1575.97
	Solid excrement per day	1356.4	445.4	24.54	33.50	33.23	15.72	214.08	157.60
	Total digested per day	....	416.9	7.52	15.67	3.76	2.29	270.53	121.82
	Per cent. digested	....	48.35	23.46	32.53	10.16	12.72	55.82	43.60
	Mean of both animals	....	51.2	23.	33.5	18.3	17.6	58.	48.

Mean nutritive ratio of old timothy hay 1:26.1.

TABLE III.—Showing Nutrients Consumed and Excreted in Grams with Percentages Digested.

Second Experiment, Timothy Hay, 16 to Cotton-seed Meal 1.

SHEEP NO. 1.

Analysis No.		Total Amount.	Total Dry Matter.	DRY MATTER CONTAINS					
				Ash.	Protein (N×6.25)	Albuminoids (Alb. N ×6.25)	Fat. (Ether Extract.)	N-free Extract.	Crude Fiber.
656	Timothy hay fed	10206.	9251.7	357.12	523.65	408.93	195.21	5173.55	3002.18
660	Cotton-seed meal fed	637.9	575.6	39.89	275.08	271.51	60.32	168.65	31.66
	Total fed	10843.9	9827.3	397.01	798.73	680.44	255.53	5342.20	3033.84
671	Waste	624.	528.5	40.96	40.06	29.91	10.94	256.27	180.27
	Total consumed	....	9298.8	356.05	758.67	650.53	244.59	5085.93	2853.57
669	Total solid excrement	13270.	3994.3	254.44	360.29	321.94	124.62	1884.51	1370.44
	Total digested	....	5304.5	101.61	398.38	328.59	119.97	3201.42	1483.13
	Per cent. digested	....	57.04	28.54	52.51	50.51	49.05	62.95	51.97
	SHEEP NO. 2.								
656	Timothy hay fed	10206.	9251.7	357.12	523.65	408.93	195.21	5173.55	3002.18
660	Cotton-seed meal fed	637.9	575.6	39.89	275.08	271.51	60.32	168.65	31.66
	Total fed	10843.9	9827.3	397.01	798.73	680.44	255.53	5342.20	3033.84
672	Waste	1726.	1495.6	71.94	88.39	85.55	33.35	785.19	516.73
	Total consumed	9117.9	8332.7	325.07	710.34	594.89	222.18	4557.01	2517.11
	Total solid excrement	14058.5	3867.5	269.56	363.16	330.28	108.68	1763.19	1362.91
	Total digested	....	4465.2	55.51	347.18	264.61	113.50	2793.82	1154.20
	Per cent. digested	....	53.59	17.08	48.88	44.48	51.09	61.31	45.85
	Mean per cent. of ration digested by two sheep	....	55.3	22.8	50.7	47.5	50.1	62.1	48.9

Mean nutritive ratio of Timothy hay 16 to cotton-seed meal 1, 1:12.4.

TABLE IV.—Showing Nutrients Consumed and Execreted in Grams with Percentages Digested.

Third Experiment, Timothy Hay 12 to Cotton-seed Meal 1).

SHEEP No. 1.

Analysis No.		Dry Matter.	Total Dry Matter.	DRY MATTER CONTAINS. Ash.	Protein (N×6.25).	Albuminoids (Alb. N ×6.25)	Fat (Ether Extract).	N-Free Extract.	Crude Fiber.
677	Timothy hay fed	9355.5	8337.6	380.19	499.42	438.56	178.42	4401.42	2878.14
660	Cotton-seed meal	779.6	703.5	48.75	336.20	331.84	73.73	206.13	38.69
	Total fed	10135.1	9041.1	428.94	835.62	770.40	252.15	4607.55	2916.83
675	Waste	82.0	67.60	3.68	6.80	5.94	1.75	33.31	22.06
	Total consumed	10053.1	8973.5	425.26	828 82	764.46	250.40	4574.24	2894.77
673	Total solid excrement	12541.	3885.3	294.89	346.57	315.10	88.20	1737.89	1417.75
	Total digested	....	5088.2	130.37	482.25	449.36	162.20	2836.35	1477.02
	Per cent. digested	....	56.70	30.66	58.19	58.78	64.78	62.01	51.02

Nutritive ratio of ration 1:9.8.

SHEEP No. 2.

Analysis No.		Dry Matter.	Total Dry Matter.	Ash.	Protein (N×6.25).	Albuminoids (Alb. N ×6.25)	Fat (Ether Extract).	N-Free Extract.	Crude Fiber.
677	Timothy hay fed	9355.5	8337.6	380.19	499.42	438.56	178.42	4401.42	2878.14
660	Cotton-seed meal fed	779.6	703.5	48.75	366.20	331.84	73.73	206.13	38.69
	Total fed	10135.1	9041.10	428.94	835.62	770.40	252.15	4607.55	2916.83
676	Waste	100.	85.45	4.20	6.61	5.41	1.70	43.16	29.77
	Total consumed	10035.1	8955.65	424.74	829.01	764.99	250.45	4564.39	2887.06
674	Total solid excrement	18615.	4429.2	374.71	400.84	363.19	91.68	1925.82	1636.15
	Total digested	....	4526.43	50.03	428.17	401.80	158.77	2638.57	1250.91
	Per cent. digested	....	50.54	11.78	51.65	52.52	63.39	57.81	43.33
	Mean of both animals	....	53.6	21.2	55.9	55.7	64.1	59.9	47.2

Ratio of ration, 1:10.0. Mean nutritive ration, hay 12 to meal 1, 1:9.9.

TABLE V.—Showing Nutrients Consumed and Excreted in Grams with Percentages Digested.

Fourth Experiment, Timothy Hay, 8 to Cotton-seed Meal 1.

SHEEP No. 1.

Analysis No.		Total Amount.	Total Dry Matter.	DRY MATTER CONTAINS. Ash.	Protein (N × 6.25)	Albuminoids (Alb. N ×6.25)	Fat (Ether Extract).	N-free Extract.	Crude Fiber.
677	Timothy hay fed	9072.	8085.0	368.68	484.29	425.27	173.02	4268.07	2790.94
660	Cotton-seed meal fed	1134.	1023.3	70.91	489.04	482.69	107.24	299.83	56.28
	Total fed	10206.	9108.3	439.59	973.33	907.96	280.26	4567.90	2847.22
678	Waste	72.	57.4	5.45	10.23	6.66	1,99	24.13	15.61
	Total consumed	....	9050.9	434.14	963.10	901.30	278.27	4543.77	2831.61
680	Total solid excrement	15911.5	4465.0	375 95	422.84	371.04	104.93	1968.17	1593.11
	Total digested	....	4585.9	58.19	540.26	530.26	173.34	2575.60	1238.50
	Per cent. digested	....	50.67	13 40	56 10	58.83	62.29	56.68	43.73

Nutritive ratio of ration, 1:7.86.

SHEEP No. 2.

Analysis No.		Total Amount.	Total Dry Matter.	Ash.	Protein (N × 6.25)	Albuminoids (Alb. N ×6.25)	Fat (Ether Extract).	N-free Extract.	Crude Fiber.
677	Timothy hay fed	9072.	8085.0	368.68	484.29	425.27	173.02	4268.07	2790.94
660	Cotton-seed meal fed	1134.	1023.3	70.91	489.04	482.69	107.24	299.83	56.28
	Total fed	10206.	9108.3	439.59	973.33	907.96	280.26	4567.90	2847.22
679	Waste	236.5	208.5	11.47	16.68	13.68	5.15	105.36	69.85
	Total consumed	....	8899.8	428.12	956.65	894.28	275.11	4462.54	2777.37
681	Total Solid excrement	21206.	4705.3	396.66	442.30	376.42	108.22	2084.45	1673.68
	Total digested	....	4194.5	31.46	514.35	517.86	166.89	2378.09	1103.69
	Per cent. digested	....	47.13	7.35	53.77	57.91	60.66	53.29	39.74
	Mean of both animals	.....	48.9	10.4	54.9	58.4	61.5	55 0	41.7

Nutritive ratio of ration, 1:7.58. Mean nutritive ratio of ration of hay 8 to meal 1 on dry matter, 7.91 to 1, was 1:7.72.

TABLE No. VI.—Showing Nutrients Consumed and Excreted in Grams with Percentages Digested.

(Fifth Experiment, Timothy Hay 4 to Cotton-seed Meal 1. Collection Period October 26th to November 5th, 1895).

SHEEP No. 1.

No. of Analysis.		Total Amount.	Total Dry Matter.	DRY MATTER CONTAINS Ash.	Protein (N×6.25).	Albuminoids (Alb. N × 6.25).	Fat (Ether Extract).	N-free Extract.	Crude Fiber.
677	Timothy hay fed	7371.	6569.0	299.55	393.48	345.53	140.58	3467.78	2267.62
660	Cotton-seed meal fed	1842.8	1662.9	115.24	794.70	784.39	174.27	487.23	91.46
	Total fed	9213.8	8231.9	414.79	1188.18	1129.92	314.85	3955.01	2359.08
685	Waste	33.0	24.5	5.97	7.66	6.98	1.69	6.53	2.66
	Total consumed	....	8207.4	408.82	1180.52	1122.94	313.16	3948.48	2356 42
683	Total solid excrement	16832.	3974.4	421.29	474.54	410.16	65.18	1671.24	1342.15
	Total digested	....	4233.0	12.47	705.98	712.78	247.98	2277 24	1014.27
	Per cent. digested	....	51.58	....	59.80	63.47	79.19	57.67	43.04

Nutritive ratio of ration 1: 5.54.

SHEEP No. 2.

No. of Analysis.		Total Amount.	Total Dry Matter.	DRY MATTER CONTAINS Ash.	Protein (N×6.25).	Albuminoids (Alb. N × 6.25).	Fat (Ether Extract).	N-free Extract.	Crude Fiber.
677	Timothy hay fed	7371.	6569.0	299.55	393.48	345.53	140.58	3467.78	2267.62
660	Cotton-seed meal fed	1842.8	1662.9	115.24	794.70	784.39	174.27	487.23	91.46
	Total fed	....	8231.9	414.79	1188.18	1129.92	314.85	3955.01	2359.08
686	Waste	402.0	341.5	17.01	27.01	25.31	9.05	181.64	106.79
	Total consumed	....	7890.4	397.78	1161.17	1104.61	305.80	3773.37	2252.29
684	Total solid excrement	18799.	3836.9	375.25	448.53	411.32	90.93	1625.31	1296.87
	Total digested	....	4053.5	22.53	713.64	693.29	214.87	2148.06	955.42
	Per cent. digested	....	51.37	56.64	61.37	62.76	70.26	56.93	42.42
	Average per cent. digested	....	51.5	*5.7	60.59	63.12	74.73	57.30	42.73

*Only for Sheep No. 2.

Nutritive ratio 1:5.10. Mean nutritive ratio of ration of hay 4 to meal 1, on dry matter 3.95 to 1, 1:5.3.

TABLE VII.—Showing Nutrients Consumed and Excreted in Grams with Percentages Digested.

Sixth Experiment, Timothy Hay 2 to Cotton-seed Meal, 1 fed.

SHEEP NO. 1.

No. of Analysis.		Total Amount.	Total Dry Matter.	DRY MATTER CONTAINS. Ash.	Protein (N X6.25).	Albuminoids (Alb. N X6.25).	Fat (Ether Extract).	N-Free Extract.	Crude Fiber.
677	Timothy hay fed	5670.	5053.1	230.42	302.68	265.79	108.14	2667.53	1744.33
660	Cotton-seed meal fed	2835.	2558.3	177 29	1222.61	1206 75	268.11	749.58	140.71
	Total fed	8505.	7611.4	407.71	1525.29	1472.54	376.25	3417.11	1885.04
689	Waste	34.5	27.6	3.06	9.88	8.95	2.24	8.57	3.86
	Total consumed	8470.5	7583.8	404.65	1515.41	1463.59	374.01	3408.54	1881.18
687	Total solid excrement	10377.5	2887.0	319.30	412.26	368.09	55.14	1050.87	1049.42
	Total digested		4696.8	85.35	1103.15	1095.50	318.87	2357.67	831.76
	Per cent. digested		61.93	21.09	72.80	74.85	85.26	69.17	44.21

Nutritive ratio of ration, 1: 3.61.

SHEEP NO. 2.

No. of Analysis.		Total Amount.	Total Dry Matter.	Ash.	Protein (N X6.25).	Albuminoids (Alb. N X6.25).	Fat (Ether Extract).	N-Free Extract.	Crude Fiber.
677	Timothy hay fed	5670.	5053.1	230.42	302.68	265.79	108.14	2667.53	1744.33
660	Cotton-seed meal fed	2835.	2558.3	177.29	1222.61	1206.75	268.11	749.58	140.71
	Total fed	8505.0	7611.4	407.71	1525.29	1472.54	376.25	3417.11	1885.04
690	Waste	26.5	24.0	2.64	9.00	8.16	2.01	7.32	3.03
	Total consumed	8478,5	7587.4	405.07	1516.29	1464.38	374.24	3409.79	1882.01
688	Total solid excrement	14934 5	3318.0	371.62	454.23	396.17	58.07	1204.77	1229.32
	Total digested		4269.4	33.45	1062.06	1068.21	316.17	2205.02	652.69
	Per cent. digested		56.27	8.26	70.04	72.95	84.48	64.67	34.68
	Average per cent. digested by two sheep		59.1	14.68	71.42	73.90	84.87	66.92	39.45

Nutritive ratio of ration, 1: 3.43; Mean nutritive ratio of ration, 1: 3.5.

TABLE VIII.—Showing Nutrients Consumed and Execreted in Grams with Peroentages Digested.

Seventh Experiment, Timothy Hay and Cotton-seed Meal, 1 to 1.

SHEEP NO. 1.

No. of Analysis.		Total Amount.	Total Dry Matter.	DRY MATTER CONTAINS					
				Ash.	Protein (N×6.25).	Albuminoids (Alb. N × 6.25).	Fat (Ether Extract).	N-free Extract.	Crude Fiber.
677	Timothy hay fed	5103.	4547.8	207.38	272.41	239.21	97.32	2400.78	1569.90
660	Cotton-seed meal fed	5103.	4604.9	319.12	2200.68	2172.13	482.59	1349.24	253.27
	Total fed	10206.	9152.7	526.50	2473.09	2411.34	579.91	3750.02	1823.17
700	Waste timothy hay	247.0	229.3	12.61	36.34	31.60	7.89	95.09	77.37
699	Waste cotton-seed meal	109.0	101.7	8.01	50.98	46.85	10.42	23.19	9.09
	Total waste	356.0	331.0	20.62	87.32	78.45	18.31	118.28	86.46
	Total consumed	9850.	8821.7	505.88	2385.77	2332.89	561.60	3631.74	1736.71
697	Total solid excrement	9601.5	3286.1	363.11	573.10	482.73	59.81	1020.33	1269.75
	Total digested	....	5535.6	142.77	1812.67	1850.16	501.79	2611.41	466.96
	Per cent. digested	....	62.75	28.22	75.98	79 31	89.35	71.91	26.89

Nutritive ratio of ration, 1: 2.39.

SHEEP NO. 2.

No. of Analysis.		Total Amount.	Total Dry Matter.	Ash.	Protein (N×6.25).	Albuminoids (Alb. N × 6.25).	Fat (Ether Extract).	N-free Extract.	Crude Fiber.
677	Timothy hay fed	5103.	4547.8	207.38	272.41	239.21	97.32	2400.78	1569.90
660	Cotton-seed meal fed	5103.	4604.9	319.12	2200.68	2172.13	482.59	1349.24	253.27
	Total fed	10206.	9152.7	526.50	2473.09	2411.34	579.91	3750.02	1823.17
701	Waste	37.	29.5	3.16	12.92	11.81	2.33	7.12	3.97
	Total consumed	....	9123.2	523.34	2460.17	2399.53	577.58	3742.90	1819.20
698	Total solid excrement	10658.0	3644.1	384.09	609.29	504.34	70.33	1284.91	1295.48
	Total digested	....	5479.1	139.25	1850.88	1895.19	507.25	2457.99	523.72
	Per cent. digested	....	60.06	26.61	75.23	78.98	87.82	65.67	28.79
	Average per cent. digested by two animals	....	61.4	27.4	75.6	79.2	89.	68.8	27.8

Nutritive ratio of ration, 1: 2.3; Mean nutritive ratio of ration, 1: 2.34.

TABLE IX.—Showing Nutrients Consumed and Excreted in Grams with Percentages Digested.

(Eighth Experiment, Second lot of Timothy Hay alone).

SHEEP NO. 1.

No. of Analysis.		Total Amount.	Total Dry Matter.	DRY MATTER CONTAINS					
				Ash.	Protein (N × 6.15).	Albuminoids (Alb. N × 6.25).	Fat.	N-free Extract.	Crude Fiber.
677	Timothy hay fed	10206.	9095.6	414.76	544.83	478.43	194,65	4801.57	3139.80
704	Waste	1905.	1630.9	78.28	106.01	96.55	36.37	723.96	686.28
	Total consumed	8301.	7464.7	336.48	438.82	381.88	158.28	4077.61	2453.52
702	Total solid excrement	9564.5	3132.9	225.26	266.92	221.18	74.25	1261.93	1304.54
	Total digested	....	4331.8	111.22	171.90	160.70	84.03	2815.68	1148.98
	Per cent. digested	....	58.03	33.05	39.17	42.08	53.09	69.05	46.83

Nutritive ratio 1:24.3.

SHEEP NO. 2.

No. of Analysis.		Total Amount.	Total Dry Matter.	Ash.	Protein (N × 6.15).	Albuminoids (Alb. N × 6.25).	Fat.	N-free Extract.	Crude Fiber.
677	Timothy hay fed	10206.	9095.6	414.76	544.83	478.43	194.65	4801.57	3139.80
705	Waste	643.	563.9	26.22	32.59	28.93	19.68	254.54	230.86
	Total consumed	....	8531.7	388.54	512.24	449.50	174.97	4547.03	2908.94
703	Total solid excrement	16079.5	4237.0	293.62	353.79	315.23	95.76	1678.70	1815.13
	Total digested	....	4294.7	94.92	158.45	134.27	79.21	2868.33	1092.81
	Per cent. digested	....	50.34	24.43	30.93	29.87	45.27	63.08	37.60
	Average per cent. digested, mean of two animals	....	54.2	28.7	35.1	36.	49.2	66.1	42.2

Nutritive ratio 1:26. Mean nutritive ratio 1:25.3.

TABLE X.—Showing Nutrients Consumed and Excreted in Grams with Percentages Digested.

SHEEP NO. 1—TENTH EXPERIMENT.

No. of Analysis.	CRAB-GRASS HAY ALONE.	Total Amount.	Total Dry Matter.	DRY MATTER CONTAINS. Ash.	Protein (N×6.25).	Albumin'ds (Alb. N ×6.25).	Fat (Ether Extract.)	N-Free Extract.	Crude Fiber.
708	Crab-grass hay fed	9072.0	7890.8	505.80	394.54	318.00	172.02	3584.00	3234.44
	Waste crab-grass hay	3039.	2689.3	151.41	168.35	150.60	69.38	1261.28	1038.88
706	Total consumed	......	5201.5	354.39	226.19	167.40	102.64	2322.72	2195.56
	Total solid excrement	7467.5	2421.1	203.37	243.56	205.79	59.32	1118.79	796.06
	Total digested	....	2780.4	151.02	17.37	....	43.32	1203 93	1399.50
	Per cent. digested	....	53.45	42.62	....	......	42.21	51.83	63.74

SHEEP NO. 2.

No. of Analysis.	CRAB-GRASS HAY ALONE.	Total Amount.	Total Dry Matter.	Ash.	Protein (N×6.25).	Albumin'ds (Alb. N ×6.25).	Fat (Ether Extract.)	N-Free Extract.	Crude Fiber.
709	Crab-grass hay fed	10206.	8877.2	569.03	443.86	357.75	193.52	4032.02	3638.76
	Waste crab-gras hay	3574.	3176.8	158.84	163.92	142.00	68.94	1472.45	1312.65
707	Total consumed	......	5700.4	410.19	279.94	215.75	124.58	2559.57	2326 11
	Total solid excrement	14694.5	2768.8	251.96	278.54	250.85	68.11	1225.19	944.99
	Total digested.	....	2931.6	158.23	1.40	....	56.47	1334.38	1381.12
	Per cent. digested	.....	51.43	38.57	00.50	.....	45.33	52.13	59.37

TABLE X—Continued.—Showing Nutrients Consumed and Excreted in Grams with Percentages Digested.

SHEEP NO. 3.

No. of Analysis.	CRAB-GRASS HAY ALONE.	Total Amount.	Total Dry Matter.	DRY MATTER CONTAINS.					
				Ash.	Protein (N×6.25).	Albumin'ds (Alb. N ×6.25).	Fat (Ether Extract.)	N-Free Extract.	Crude Fiber.
	Crab-grass hay fed	6577.2	5720.8	366.70	286.04	230.55	124.71	2598.39	2344.96
712	Waste crab-grass hay	1545.0	1353.6	64.30	61.05	50.76	26.94	644.99	556.33
	Total consumed	......	4367.2	302.40	224.99	179.79	97.77	1953.40	1788.63
710	Total solid excrement	6278.5	2294.4	161.07	209.48	187.91	49.10	983.84	890.92
	Total digested	......	2072.8	141.33	15.51	......	48.67	969.56	897.71
	Per cent. digested	......	47.46	46.73	6.89	......	49.78	49.63	50.19

SHEEP NO. 4

No. of Analysis.	CRAB-GRASS HAY ALONE.	Total Amount.	Total Dry Matter.	Ash.	Protein (N×6.25).	Albumin'ds (Alb. N ×6.25).	Fat (Ether Extract.)	N-Free Extract.	Crude Fiber.
	Crab-grass hay	7030.8	6115.4	392.00	305.77	246.45	133.32	2777.61	2506.70
713	Waste crab-grass hay	4380.	3898.8	232.76	245.23	212.09	96.30	1728.73	1595.78
	Total consumed	......	2216.6	159.24	60.54	34.36	37.02	1048.88	910.92
711	Total solid excrement	2847.	1102.5	80.04	113.34	105.40	24.81	520.82	363.49
	Total digested	......	1114.1	79.20	52.80	......	12.21	528.06	547.43
	Per cent. digested	......	50.26	49.74	......	......	32.98	50.35	60.10
	Average per cent. digested, mean of four animals.	......	50.7	44.4	......	......	42.6	51.	58.4

Mean nutritive ratio, 1: 99.5.

SHEEP NO. 1.—Second Experiment.

No. of Analysis.		Total Amount.	Dry Matter.	DRY MATTER CONTAINS. Ash.	Protein.	Albumin'ds (Alb. N ×6.25).	Fat.	N—Free Extract.	Crude Fiber.
656	Timothy hay fed	10206.	9251.7	357.12	523.65	408.93	195.21	5173.55	3002.18
671	Waste timothy hay	624.	528.5	40.96	40.06	29.91	10.94	256.27	180.27
	Timothy hay consumed	9582.	8723.2	316.16	483.59	379.02	184.27	4917.28	2821.91
660	Cotton-seed meal consumed	637.9	575.6	39.89	275.08	271.51	60.32	168.65	31.66
	Total consumed		9298.8	356.05	758.67	650.53	244.59	5085 93	2853.57
669	Total solid excrement	13270.	3994.3	254.44	360.29	321.94	124.62	1884.51	1370.44
	Total digested		5304.5	101.61	398.38	328.59	119.97	3201.42	1483.13
	Digested from cotton seed meal*		421.9	12.57	241.52	236.49	54.11	103.72	14.69
	Digested from timothy hay		4882.6	89.04	156.86	92.10	65.86	3097.70	1468.44
	Per cent. digested from timothy hay		55.97	28.16	32.44	24.30	35.74	63.0	52.04

SHEEP NO. 2.

	Total Amount.	Dry Matter.	Ash.	Protein.	Albumin'ds (Alb. N ×6.25).	Fat.	N—Free Extract.	Crude Fiber.
Timothy hay fed	10206.	9251.7	357.12	523.65	408.93	195.21	5173.55	3002.18
Waste timothy hay	1726.	1495.6	71.94	88.39	85.55	33.35	785.19	516.73
Timothy hay consumed	8480.	7756.1	285.18	435.26	323.38	161.86	4388.36	2485.45
Cotton seed meal consumed	637.	576.6	39.89	275.08	291.51	60.32	168.65	31.66
Total consumed	9117.	8332.7	325.07	710.34	594.89	222.18	4557.01	2517.11
Total solid excrement	14058.5	3867.5	269.56	363.16	330.28	108.68	1763.19	1362.91
Total digested		4465.2	55.51	347.18	264.61	113.50	2793.82	1154.20
Digestd from cotton seed-meal*		421.9	12.57	241.52	236.49	54.11	103.72	14.69
Digested from timothy hay		4043.3	42.94	105.66	28.12	59.39	2690.10	1139.51
Per cent. digested from timothy hay		52.13	16.63	24.28	8.70	36.69	61.30	45.84
Average per cent. for both animals†		54.1	22.4	28.4	16.5	36.2	62.2	48.9

*Coefficients from B. 97, page 116. †Ratio 1: 33.2

SHEEP NO. 1.—THIRD EXRERIMENT.

No. of Analysis.		Total Amount.	Dry Matter.	DRY MATTER CONTAINS. Ash.	Protein.	Albuminoids (Alb. N × 6.25).	Fat.	N—Free Extract.	Crude Fiber.
677	Timothy hay fed	9355.5	8337.6	380.19	499.42	438.56	178.42	4401.42	2878.14
675	Waste timothy hay	82.	67.6	3.68	6.80	5.94	1.75	33.31	22.06
	Timothy hay consumed	9273.5	8270.0	376.51	492.62	432.62	176.67	4368.11	2856.08
	Cotton-seed meal consumed	779.6	703.5	48.75	336.20	331.84	73.73	206.13	38.69
	Total consumed	10053.1	8973.5	425.26	828.82	764.46	250.40	4574 24	2894.77
	Total solid excrement	12541.0	3885.3	294.89	346.57	315.10	88.20	1737.89	1417.75
	Total digested		5088.2	130.37	482.25	449.36	162.20	2836.35	1477.02
	Digested from cotton-seed meal*		515.7	15.36	295.18	289.03	66.14	126.77	17.95
	Digested from timothy hay		4572.5	115.01	187.07	160.33	96.06	2709.58	1459.07
	Per cent. digested from timothy hay		55.29	30.55	37.97	13.95	54.37	62.03	51.09

SHEEP NO. 2.

No. of Analysis.		Total Amount.	Dry Matter.	Ash.	Protein.	Albuminoids (Alb. N × 6.25).	Fat.	N—Free Extract.	Crude Fiber.
677	Timothy hay fed	9355.5	8337.6	380.19	499.42	438.56	178.42	4401.42	2878.14
676	Waste, timothy hay	100.	85.5	4.20	6.61	5.41	1.70	43.16	29.77
	Timothy hay consumed.	9255.5	8252.1	375.99	492.81	433.15	176.72	4358.26	2848.37
	Cotton-seed meal consumed	779.6	703.5	48.75	336.20	331.84	73.73	206.13	38.69
	Total consumed	10035.1	8955.6	424.74	829.01	764.99	250.45	4564.39	2887.06
	Total solid excrement	18615.	4429.2	374.71	400.84	363.19	91.68	1925.82	1636.15
	Total digested		4526.4	50.03	428.17	401.80	158.77	2638.57	1250.91
	Digested from cotton-seed meal*		515.7	15.36	295.18	289.03	66.14	126.77	17.95
	Digested from timothy hay		4010.7	34.67	132.99	112.77	92.63	2511.80	1232.96
	Per cent. digested from timothy hay		48.60	9.32	26.99	26.03	52.42	57.63	43.29
	Mean per cent. digested from timothy hay by two animals		52.	19.9	32.5		53.4	59.8	47.2

*Coefficients from B. 97, page 116. Ratio 1:26.3.

SHEEP NO. 1.—FOURTH EXPERIMENT.

No. of Analysis.		Total Amount.	Dry Matter.	DRY MATTER CONTAINS					
				Ash.	Protein.	Albuminoids (Alb. N ×6.25).	Fat.	N—Free Extract.	Crude Fiber.
677	Timothy hay fed	9072.0	8085.0	368.68	484.29	425.27	173.02	4268.07	2790.94
678	Waste, calculated as timothy hay	72.0	57.4	5.45	10.23	6.66	1.99	24.13	15.61
	Timothy hay consumed	9000.0	8027.6	363.23	474.06	418.61	171.03	4243.94	2775.33
660	Cotton-seed meal consumed	1134.0	1023.3	70.91	489.04	482.69	107.24	299.83	56.28
	Total consumed	10134.0	9050.9	434.14	963.10	901.30	278.27	4543.77	2831.61
680	Total solid excrement	15911.5	4465.0	375.95	422.84	371.04	104.93	1968.17	1593.11
	Total digested		4585.9	58.19	540.26	530.26	173.34	2575.60	1238.50
	Digested from cotton-seed meal*		750.1	22.34	429.38	420.42	96.19	184.40	26.11
	Digested from timothy hay		3835.8	35.85	110.88	109.84	77.15	2391.20	1212.39
	Per cent. digested from timothy hay		47.78	9.87	23 39	26.24	45.11	56.34	43.68
	SHEEP NO. 2.								
677	Timothy hay fed	9072.	8085.0	368.68	484.29	425.27	173.02	4268.07	2790.94
679	Waste, calculated as timothy hay	236.5	208.5	11.47	16.68	13.68	5.15	105.36	69.85
	Timothy hay consumed		7876.5	357.21	467.61	411.59	167.87	4162.71	2721.09
660	Cotton-seed meal consumed	1134.0	1023.3	70.91	489.4	482.69	107.24	299.83	56.28
	Total consumed		8899.8	428 12	956.65	894.28	275.11	4462.54	2777.37
681	Total solid excrement	21206.	4075.3	396.66	442.30	376.42	108.22	2084.45	1673.68
	Total digested		4194.5	31.46	514.35	517.84	166.89	2378.09	1103.69
	Digested from cotton-seed meal*		750.1	22.34	429.38	420.42	96.19	184.40	26.11
	Digested from timothy hay		3444.4	9.12	84.97	97.42	70.70	2193.69	1077.58
	Per cent. digested from timothy hay		43.73	2.55	18.17	23.67	42.12	52.70	39.60
	Mean per cent. digested from timothy hay by two animals		45.8	6.2	20.8	25.0	43.6	54.5	41.6

*Coefficients from B. 97, page 116.

SHEEP NO. 1.—FIFTH EXPERIMENT.

No. of Analysis.		Total Amount.	Dry Matter.	DRY MATTER CONTAINS					
				Ash.	Protein.	Albuminoids (Alb. N ×6.25).	Fat.	N-Free Extract.	Crude Fiber.
677	Timothy hay fed	7371.	6569.0	299 55	393.48	345.53	140.58	3467.78	2267.62
660	Cotton-seed meal fed	1842.8	1662.9	115.24	794.70	784.39	174.27	487.23	91.46
685	Waste, (manger scrapings) calculated as cotton-seed meal	33.	24.5	5.97	7.66	6.98	1.69	6.53	2.66
	Consumed from cotton-seed meal	....	1638.4	109.27	787.04	777.41	172.58	480.70	88.80
	Total consumed	....	8207.4	408.82	1180.52	1122.94	313.16	3948.48	2356.42
683	Total solid excrement	....	3974.4	421.29	474 54	410.16	65.18	1671.24	1342 15
	Total digested	....	4233.0	12.47	705.98	712.78	247.98	2277.24	1014.27
	Digested from cotton-seed meal*	....	1200.9	31 42	691.02	677.12	154.80	295 63	41.20
	Digested from timothy hay	....	3032.1	....	14.96	35.66	93.18	1981.61	973.07
	Per cent. digested from timothy hay	....	46.16	....	3.80	10.32	66.28	57.14	42.91

SHEEP NO. 2.

No. of Analysis.		Total Amount.	Dry Matter.	Ash.	Protein.	Albuminoids (Alb. N ×6.25).	Fat.	N-Free Extract.	Crude Fiber.
677	Timothy hay fed	7371.	6569.	299.55	393.48	345.53	140.58	3467.78	2267.62
686	Waste, calculated as timothy hay	402.	3415.	17.01	27.01	25.31	9.05	181.64	106.79
	Timothy hay consumed	.....	6227.5	282.54	366.47	320.22	131.53	3286.14	2160.83
660	Cotton-seed meal consumed	1842.8	1662.9	115.24	794 70	784.39	174.27	487.23	91.46
	Total consumed	....	7890.4	397.78	1161.17	1104.61	305.80	3773.37	2252.29
684	Total solid excrement	18799.	3836.9	375.25	448.53	411.32	90.93	1625.31	1296.87
	Total digested	....	4053.5	22.53	712.64	693.29	214.87	2148.06	955.42
	Digested from cotton-seed meal *	....	1218.9	36.30	697.75	683.20	156.32	299.65	42.44
	Digested from timothy hay	....	2834.6	13.77	14.89	10.09	58.55	1848.41	912.98
	Per cent. digested from timothy hay	....	45.52	....	4.06	3.15	44.51	56.25	42.25
	Mean per cent. digested from timothy hay by two animals	....	45 8	......	3.9	6.7	55.4	56.7	42.6

*Coefficients from B. 97, page 116.

SHEEP NO. 1.—SIXTH EXPERIMENT.

No. of Analysis.		Total Amount.	Dry Matter.	DRY MATTER CONTAINS					
				Ash.	Protein.	Albuminoids (Alb. N ×6.25).	Fat.	N-Free. Extract.	Crude Fiber.
677	Timothy hay fed and eaten	5670.	5053.1	230.42	302.68	265.79	108.14	2667.53	1744.33
660	Cotton-seed meal fed	2835.	2558.3	177.29	1222.61	1206.75	268.11	749.58	140.71
689	Waste, calculated as cotton-seed meal	34.5	27.6	3.06	9.88	8.95	2.24	8.57	3.86
	Consumed from cotton-seed meal	....	2530.7	174.23	1212.73	1197.80	265.87	741.01	136.85
	Total consumed	....	7583.8	404.65	1515.41	1463.59	374.01	3408.54	1881.18
687	Total solid excrement	10377.5	2887.0	319.30	412.26	368.09	55.14	1050.87	1049.42
	Total digested	....	4696.8	85.35	1103.15	1095.50	318.87	2357.67	831.76
	Digested from cotton-seed meal*	....	1855.0	54.88	1064.78	1043.28	238.49	455.72	63.50
	Digested from timothy hay.	....	2841.8	30.47	38.37	52.22	80.38	1901.95	768.26
	Per cent. digested from timothy hay	....	56.24	13.22	12.68	19.65	74.33	71.30	44.04
	SHEEP NO. 2.								
677	Timothy hay fed	5670.	5053.1	230.42	302.68	265.79	108.14	2667.53	1744.33
660	Cotton-seed meal fed	2835.	2558.3	177.29	1222.61	1206.75	268.11	749.58	140.71
690	Waste, cotton-seed meal	26.5	24.0	2.64	9.00	8.16	2.01	7.32	3.03
	Consumed from cotton-seed meal		2534.3	174.65	1213.61	1198.59	266.10	742.26	137.68
	Total consumed		7587.4	405.07	1516.29	1464.38	374.24	3409.79	1882.01
688	Total solid excrement	14934.5	3318.0	371.62	454.23	396.17	58.07	1204.77	1229.32
	Total digested		4269.4	33.45	1062.06	1068.21	316.17	2205.02	652.69
	Digested from cotton-seed meal*		1857.6	55.01	1065.55	1043.97	238.69	456.49	63.88
	Digested from timothy hay		2411.8			24.24	77.48	1748.73	588.81
	Per cent. digested from timothy hay		47.73			9.12	71.65	65.55	33.76
	Mean per cent. digested by two animals		52.0	†13.2	†12.7	14.4	73.0	68.4	38.9

*Coefficients from B. 97, page 116. †Sheep No. 1 only.

SHEEP NO. 1.—SEVENTH EXPERIMENT.

No. of Analysis.		Total Amount.	Dry Matter.	DRY MATTER CONTAINS					
				Ash.	Protein.	Albuminoids (Alb. N ×6.25).	Fat.	N-Free Extract.	Crude Fiber.
677	Timothy hay fed	5103.0	4547.8	207.38	272.41	239.91	97.32	2400.78	1569.90
700	Waste, timothy hay	247.0	229.3	12.61	36.34	31.60	7.89	95.09	77.37
	Consumed in timothy hay		4318.5	194.77	236.07	207.61	89.43	2305.69	1492.53
660	Cotton-seed meal fed	5103.	4604.9	319.12	2200.68	2172.13	482.59	1349.24	253.27
669	Waste, cotton-seed meal	109.	101.7	8.01	50.98	46.85	10.42	23.19	9.09
	Consumed in cotton-seed meal		4503.2	311.11	2149.70	2125.28	472.17	1326.05	244.18
	Total consumed		8821.7	505.88	2385.77	2332.89	561.60	3631.74	1736.71
697	Total solid excrement	9601.5	3286.1	363.11	573.10	482.73	59.81	1020.33	1269.75
	Total digested		5535.6	142.77	1812.67	1850.16	501.79	2611.41	466.96
	Digested from cotton-seed meal*		3300.8	98.00	1877.44	1851.12	423.54	815.52	113.33
	Digested from timothy hay		2234.85	44.77			78.25	1795.89	353.63
	Per cent. digested from timothy hay.		51.7	22.99			87.50	77.89	23.69

*Coefficients from B. 97, page 116.

SHEEP NO. 2.

No. of Analysis.		Total Amount.	Dry Matter.	Ash.	Protein.	Albuminoids (Alb. N ×6.25).	Fat.	N-Free Extract.	Crude Fiber.
677	Timothy hay fed	5103.0	4547.8	207.38	272.41	239.21	97.32	2400.78	1569.90
660	Cotton-seed meal fed	5103.0	4604.9	319.12	2200.68	2172.13	482.59	1349.24	253.27
701	Waste, cotton-seed meal	37.0	29.5	3.16	12.92	11.81	2.33	7.12	3.97
	Consumed in cotton-seed meal	....	4575.4	315.96	2187.76	2160.32	480.26	1342.12	249.30
	Total consumed	....	9123.2	523.34	2460.17	2399.53	577.58	3742.90	1819.20
698	Total solid excrement	10658.	3644.1	384.09	609.29	504.34	70.33	1284.91	1295.48
	Total digested	....	5479.1	138.25	1750.88	1895.19	507.25	2457.99	523.72
	Digested from cotton-seed meal*	....	3353.8	99.53	1920.85	1881.64	430.79	825.40	115.68
	Digested from timothy hay	....	2125.3	38.72	....	13.55	76.46	1632.59	408.04
	Per cent. digested from second lot timothy hay	....	46.73	18.67	....	5.66	78.57	68.00	25.99
	Mean per cent. digested from timothy hay by two animals	....	49.24	20.83	....	....	83.03	72.95	24.84

*Coefficients from B. 97, page 116.

PASTEURIZATION OF MILK.

BY FRANK E. EMERY.

To Pasteurize is to practice after Pasteur, or to follow a method or practice of his in freeing some substances of germs—minute vegetable forms, which can only be seen by using a microscope of high power. Then Pasteurization is the act of killing germs according to the practice of Pasteur.

The original practice has been improved upon until it can be relied on implicitly to kill all active germs, and if need be to continue for a longer time, and repeat after standing some hours, or days, to sterilize or destroy all germs which may have been in a resting stage at the first operation.

Germs of some kinds are necessary to all our operations in the dairy. We cannot do without them, and would not if we could; but they are like everything else—composed of good, bad and indifferent. If the indifferent or bad germs get the upper hand in our operations, as sometimes happens in hot weather, losses occur. Even the good or friendly forms must be kept within control to a certain extent, in order that the products of our dairies shall acquire that uniformity of qualities which commends them to our customers.

Some people who lead off in new fashions go so far as to Pasteurize out the germs in their milk and put in others, which have been specially prepared, and are more or less pure in regard to the single or few species desired to give a certain desired flavor. This is for butter-making. No one has yet attempted to isolate and prepare colonies of germs which can give a given flavor in cheese, because the number of kinds which may be concerned in giving a first-class kind of cheese is as yet practically unknown.

But it is to rid ourselves of the bad germs that Pasteurization is most often introduced.

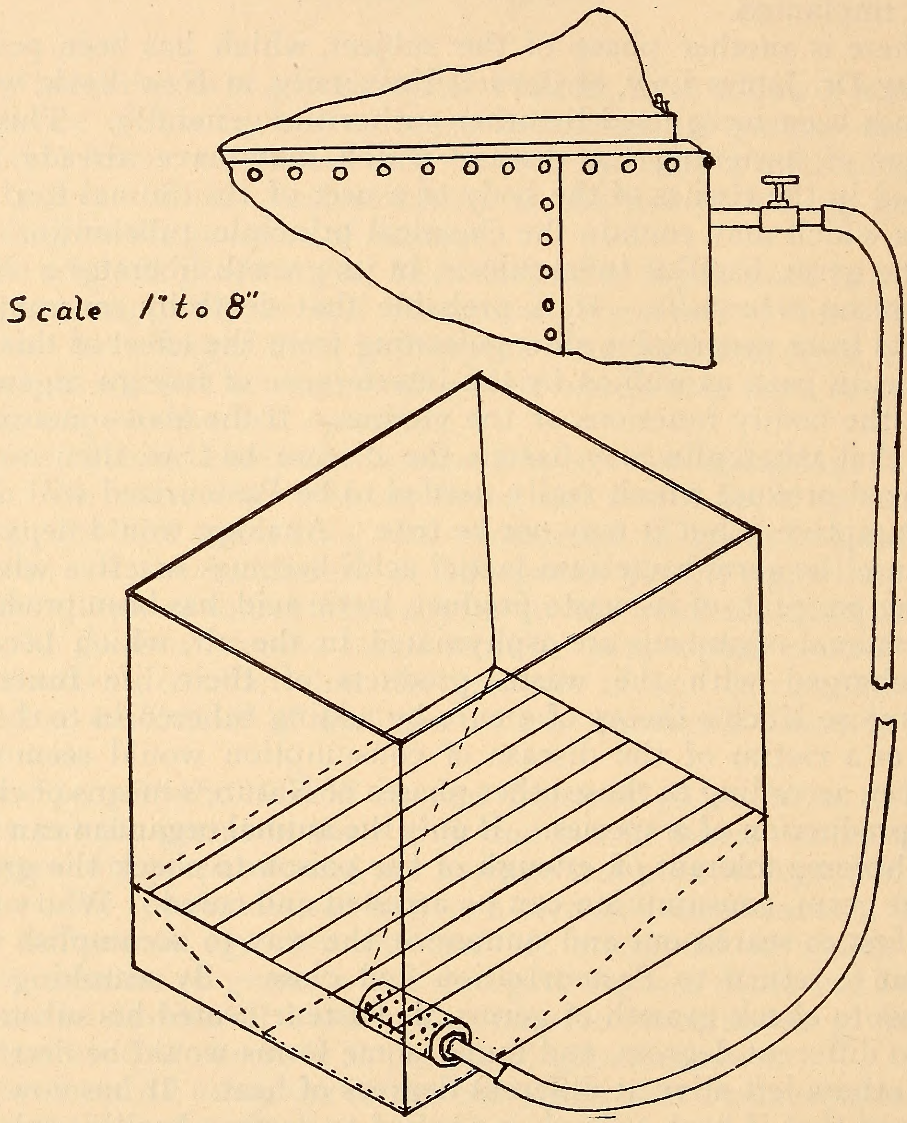
Most of the disease-producing germs, when introduced in some accidental way into milk find it a rich soil in which to multiply. Some others can live, and be transferred in it to the human system, where they can reproduce disease. Among these the cholera germ has been known to have been the cause of death from dilution with contaminated water. Had the milk soured before being used, the cholera germ would have been killed by the acid given out by one of the good forms.

Similarly the germ of consumption may gain access to milk from a cow, or from her attendant, or possibly from dust by careless handling. If this milk cools below 86° F. this germ cannot grow, but would be held alive and in readiness to grow and produce disease whenever a chance presents itself to do so. If, now, this milk is suspected, and is subjected to pasteurization, it will be killed, and no disease will be produced where it had not already been implanted.

There is another phase of the subject, which has been pointed out by Dr. James Law, of Cornell University, in New York, which has not been recognized by other authorities generally. This is a danger of hastening the disease which may have already been started in the tissues of the body of a user of the animal food products which may contain the chemical principle, tuberculin.

The germ, bacillus tuberculosis, in its growth liberates a chemical poison *tuberculin.* It is probable that death by consumption results from progressive slow poisoning from the effect of this substance, in part, as well as by the interference of foreign organisms with the bodily functions of the victims. If the above mentioned idea that tuberculin may hasten the disease be true, then no Pasteurized product which really needed to be Pasteurized will do for consumptives; but it may not be true. Analogy would deny this, because the germ bacterium lactici acidi becomes inactive when .8 of one per cent. of its waste product, lactic acid, has been produced, and animal organisms are asphyxiated in the air, which becomes overcharged with the waste products of their life functions. Therefore Koch's theory of a cure by adding tuberculin to the system of a victim of the disease of consumption would seem to be correct, according to those other phases of Nature's means of checking production of a species. If only the animal organism can bear, and become tolerant of, enough of the poison to check the growth of the germ, consumption can be arrested and cured. Who will be the first to search out and announce the way to accomplish this?

But to return to Pasteurization and close. By searching for a means to check growth of germs M. Pasteur heated his substances up to different degrees, and found some forms would be destroyed and others left alive at different degrees of heat. It has now been learned that if heat enough is applied to destroy bacillus tuberculosis, most other forms, and perhaps all other common bad forms, will also have been destroyed. Pasteur's process then means to heat up a substance to, and a little above, the thermal death point of the species to be destroyed, and if the point needed to kill B. tuberculosis is reached nearly all, if not all, other bad germs will have perished. Various experimenters have heated up media containing these germs to different degrees and have then examined with the microscope to find what is the thermal death point of this dreaded germ. It has been found that two factors control this point—the time during which the heat is raised to a given point and the height of the heat attained. Thus, to give some of these points, and the time required, we may begin with a low degree, and give the long time required first. Then pass to higher degrees and shorter times, which have been found sufficient to destroy *B. tuberculosis.*



Forster (Milch Zeitung, 1894, p. 84), quoted in "The Principles of Modern Dairy Practice," p. 158, found:

	131° F.	continued	4 hours	sufficed,	or
	140° F.	"	1 "	"	or
	158° F.	"	10 min.	"	or
	170° F.	"	5 "	"	or
	203° F.	"	1 "	"	
Bitter (*Ibid*) found	154° F.	"	30 "	"	

Dr. Law, Cornell Bulletin 65, gives Yersin as authority for a temperature of 158° F. for ten minutes.

Russel (Outlines of Dairy Bacteriology) gives the following:

140° F. for 10 minutes kills most forms.
149° F. for 30 " " B. tuberculosis.
155° F. for 15 " " B. tuberculosis.
167° F. for 10 " " B. tuberculosis.

In treating milk it must be borne in mind that milk assumes a cooked taste if heated much above 160° F., hence it is desirable to raise it to some of the lower temperatures for a long enough time and not risk changing its flavor, as it then becomes objectionable to many consumers.

This heating, or pasteurization, of milk is therefore indicated for suspicious samples before using it for human or animal food, since our domestic animals are as subject to the disease produced by this germ as are human beings. Everyone may not have need of using this method of clearing milk of dangerous germs, but it is a useful bit of knowledge to know how to use it, if unhappily it be needed. At the Experiment Farm, in 1893, a cow was suspected of being a victim of disease, and a piece of apparatus was devised in which to Pasteurize the milk. Recently it has been brought out, and a cut has been prepared to accompany these notes. A large galvanized iron can, with bottom sloping two ways to near one corner, where a steam muffle is put in, and the rubber pipe pushed on over the piece of pipe left projecting at the side. At the ends a shoulder supports an iron-rod rack, on which the glass jars, or tin cans, containing the milk to be heated, rests. The rubber hose is attached to the steam boiler, and live steam applied as desired. The large can can also be set on a stove and used in the same way, but whichever way it is used, an accurate thermometer is needed to be frequently used to see that the heat is kept up as desired, and that too high a temperature is not generated in the milk.

The diagram on page 305 illustrates the raising of the temperature in water and milk in the Pasteurizing can, the milk being of greater volume than the water.

Additions of steam can be nicely regulated to prevent too high heat in the water. The black line represents temperature of milk, and the red line* the water for one trial. The broken black and red lines represent another trial, during which the changes were not noted during the first fifteen minutes, but which shows a very steady temperature of 158 to 9° F. for 10 minutes to 15 minutes above 155° F., and 20 minutes above 150° F., after which it was allowed to cool rather slowly.

A cooler has been devised, but had not been made when our milk supply was cut off, and we have not been in need of one much since. The cooler we have made consists of a coil of pipe through a cooley milk can. The milk is drawn through this coil fast or slow, according to need from a faucet in the Pasteurizing can. The cooley can is to be filled with cold water, or water and finely broken ice, or possibly cold brine. The cooley can is large enough to serve onr purpose. On a larger scale vessels of ampler proportions will be needed.

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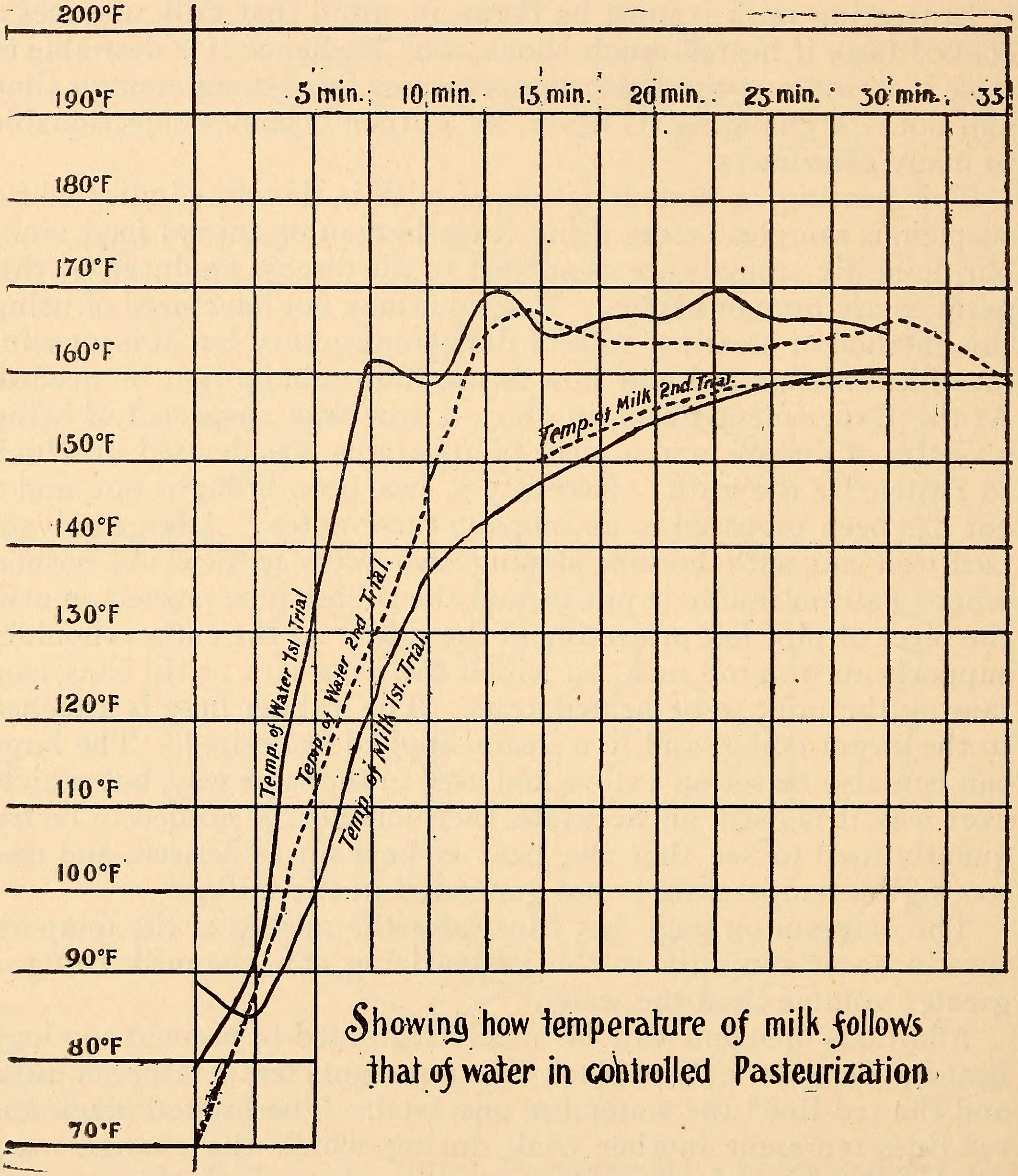
*For convenience in printing, only one color is used. and the different lines are indicated by words following each line.



Showing how temperature of milk follows that of water in controlled Pasteurization

When the required temperature at a high degree is maintained for the given time the requirement for several of the lower temperatures has been fulfilled.

The practice of Pasteurizing is somewhat troublesome, but it is a safeguard which can be easily invoked by anyone to guard against a suspicious food product, be it milk, meat, or some other article; the same degree of heat for the same length of time will free it from germs which might produce disease.

The Apple in North Carolina

A BULLETIN OF PRACTICAL INFORMATION FOR THE APPLE GROWERS
OF THE STATE.

ISSUED BY
THE NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION,
RALEIGH, N. C.

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RALEIGH, N. C.

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THE APPLE IN NORTH CAROLINA.

W. F. MASSEY, HORTICULTURIST.

INTRODUCTION.

The soil and climate of a large portion of North Carolina is well suited to the production of apples. This is particularly true of the region of elevated plateaus and valleys west of the Blue Ridge. In this favored region apples thrive and bear good crops of fine fruit under conditions of the most absolute neglect. In traversing the State during the past fall examining the nurseries and orchards for the San Jose' scale, the writer was struck with the fact that orchards that were at all cared for, are exceedingly few, and that most of the apples that grow in the mountain country grow in spite of neglect and not because of any care that is bestowed on them.

Then, too, in all the rolling upland country, east of the Blue Ridge and down as far east as the line of the Uwharrie mountains and the Occoneechee hills, apple culture could be made nearly, or quite, as profitable as in the mountain country ; and even in the coastal plain there are apples that do exceedingly well. In examining the orchards and nurseries last fall, we were struck with the fact that the nursery trees of apples in the eastern part of the State were finer than trees of the same age in the Western section, which is usually considered the best for apples.

We then venture the assertion that there is no section of the State, except, perhaps, the extreme southern corner, where apples cannot be grown in some varieties profitable, at least for home use. The complaint is general that apples do not do as well as they once did, and that insect enemies are more numerous and destructive. It is probably true that we are more annoyed by insects than formerly, but the main reason for the failure of the apple trees is starvation and neglect. Our people spend millions of dollars annually for fertilizers to put on the cotton crop and on annual grain crops, but they seem to think that because the trees in the forest take care of themselves that orchard trees can do the same. But natural conditions, such as we find in the forest, are not the conditions needed by the fruit trees. Nature is perfectly satisfied with a little crab-apple, if the tree has the robustness of constitution to survive in the struggle for existence in the forest. Nature cares nothing for the quality of the fruit, if the tree is vigorous and makes seed in plenty.

But man's wants are different. We want a tree that will produce abundant crops of fine fruit, and we ignore everything else to get this, the result being a plant that needs the fostering care of man to save it from extinction by robust wildlings. We have removed the plant from natural conditions and we must take care of it if we wish to preserve it.

Soil exhaustion is the cause of more failures in fruit than all other causes combined. Men realize that annual crops need feeding, but they do not realize that the trees in the orchard need feeding, nor, that they are removing more plant food from the soil than the annual crops. But this is true, nevertheless, for a good crop of appples will remove more mineral matter from the soil twan three crops of wheat. And yet men expect the apple orchard to produce fruit indefinitely, and at the same time grow grain or grass, or answer as a pasture. And when the soil declines to respond and give fruit when the plant food to make it is no longer there, men say the climate has changed, and that fruit cannot be grown as once it could.

It is, nevertheless, true that orcharding requires more constant attention and more hard work than it formerly did. Not only is the soil exhausted of the food the trees need, but the enemies of the tree and fruit have undoubtedly increased with the increase of cultivation and commerce, by which the injurious insects of other lands are introduced here. Hence the man who expects to succeed in orcharding to-day must be a student and a worker, ever on the alert to discover new enemies and to prevent the attacks of the old ones, too. The work that has been done and is being done at the Experiment Stations in this and other States, for the purpose of demonstrating the best food materials for fruit trees, and the best means for checking the ravages of insects and fungus diseases, is constantly pntting into the hands of growers the means for protecting their orchards. It has, therefore, come to the point that the man who would succeed in growing fruit must be a student and a workman. He should study the habits of insects so as to be able to distinguish friends from foes. He should get acquainted with the low plant organisms that make our rusts and blights, and the best means for stacking them.

Analyses of the Apple Tree and Its Products.

Apple leaves collected in May contain water, 72.36 per cent.; ash, 2.33 per cent.; nitrogen, 0.74 per cent.; phosphoric acid, .25 per cent., and potash, .25 per cent.

Collected in September, they contain water, 60.71 per cent.; ash, 3.46 per cent.; nitrogen, .89 per cent.; phosphoric acid, .19 per cent.; and potash, .39 per cent.; showing the tendency of the phosphoric acid to return to the soil at the ripening period.

Apple fruit contains water, 85.30 per cent.; ash, .39 per cent.; nitrogen, .13 per cent.; phosphoric acid, .01 per cent., and potash, .19 per cent.

The wood of the whole tree, roots and branches, averages water, 60.83 per cent.; ash, 1.50 per cent.; nitrogen, .35 per cent.; phosphoric acid, .05 per cent., and potash, .17 per cent.

A mature apple tree, then, weighing but a ton would contain, in its wood alone, 7 pounds of nitrogen, 1 pound of phosphoric acid and 3.4 pounds of potash. Estimating the crop at ten bushels for such a tree, and there will be taken from the soil in the fruit alone, about .8 of a pound of nitrogen, .2 of a pound of phosphoric acid and one 1.14 pounds potash.

Estimating 40 such trees per acre, there would be removed from the soil in such a crop per acre, 32 pounds of nitrogen, 8 pounds of phosphoric acid and 45.6 pounds of potash.

A crop of wheat of 20 bushels per acre removes from the soil in grain and straw about 29 pounds of nitrogen, 9 pounds of phosphoric acid and 5 pounds of potash.

It will be seen; then, that the draft on the soil, especially in potash, is far heavier from a crop of apples than a crop of wheat. Farmers undestand easily the reason for applying fertilizers for the wheat crop, but imagine that the orchard need no manuring, and when the trees fail we are told that "we cannot grow fruit here as we formerly did." The real reason is soil exhaustion. It has taken a great deal of plant food to build up the big tree, and supply its annual crop of leaves and fruit, and in most cases there has been a crop taken annually from the land besides. And when we consider that a ton is a small estimate for the weight of a full grown apple tree and roots, the need for annually keeping up the fertility of the soil becomes more apparent.

Seedlings vs. Grafted Fruit Trees.

There are many people who still adhere to the notion that the best way to grow a fruit tree is from the seed. Our Western mountain country is so full of seedling apples that the great difficulty in marketing apples from there at present is that there are not enough of apples of one sort known in the markets to make shipments of any size, and this has led to the practice common there of shipping mixed lots of all sorts. The great need in the apple-growing section of this State is for orchards of standard varieties enough to make them an item in the market. The mountain country is full of inferior sorts like the Red Limbertwig, which will sell only when there are no good apples to be had. If our people ever expect to reap the advantages that their soil and climate give them for the production of apples, they must stop trying to get people to buy Limbertwigs, Buffs and other inferior and worthless apples, but must grow the good ones that they can grow as easily as these poor sorts.

Where Apples Will Grow.

While the mountain country west of the Blue Ridge is pre-eminently the apple-growing section of the State, it does not by any means follow that apples cannot be grown successfully in other sections. The main reason for lack of success in the midland section of the Piedmont region is doubtless soil exhaustion and careless cultivation, or rather utter neglect of cultivation. Some of our best apples are natives of the Eastern part of the State, and there is but a limited part of the whole State where apples cannot be grown successfully if due attention is given to the orchard.

What Kind of Trees to Plant.

We have said that one of the greatest drawbacks to the success of apples in the mountain country is the great number of seedling apples that have been grown. If we are to make a reputation in the market for our apples we must grow the sorts that the markets demand, and which bring the best prices. This cannot be done by growing seedling trees. We must use grafted trees to reproduce the variety we want. Much could be done by grafting over with standard varieties all the trees of inferior sorts that now fill the orchards. We will give elsewhere a list of the sorts approved by the best growers in the State, and especially those that are proving the most profitable varieties to grow.

What Age to Plant Trees.

If we were going to take personal care of the trees we would always plant one-year-old trees of all kinds of fruits. But growers generally want a big tree, which is usually a big mistake, for the smaller young tree is usually far better and more certain to live and grow well. Then, too, the one-year-old apple tree is simply a single stem and is more easily made to form a good head than one that has been cut back and branched in the crowded nursery rows. Apple trees, and in fact all fruit trees should be headed low in this climate, and it is more easy to form the head low on a yearling tree than on one that has been allowed to branch too high in the nursery simply because the majority of buyers want them in that shape. Buy one-year trees and head them not over two feet from the ground. The trees can be bought more cheaply at that age, are easier to transplant and are less costly to transport. Of course if one is going to leave the care of the trees to ignorant labor, and is going to have them run plows through the orchard, he had better have larger trees, that they can be seen better than the little yearlings. But whatever size trees you buy, head them low. The only advantge a high-headed tree has is that a man can get under it with a mule, which is, after all, no advantge at all, for there is no use of the mule being there after the tree has gotten to a bearing size, as all the feeding roots are out about the spread of the branches and there is little need for any cultivation near the trunk. The tall tree gives the wind greater leverage and is more easily blown down. It is more difficult to gather the fruit from and is more liable to injury from sun-scald, than the low-headed one. In fact this last is one of the chief advantages of the low-headed tree, for there is probably more damage done to apple trees by sun-scald than by anything else in this climate. There is no difficulty in making the head as low as we choose if the tree is a yearling, but with older trees it is sometimes hard to get a head at the proper place after the nurseryman has started one higher up.

PREPARATION OF THE LAND FOR THE ORCHARD.

The preparation of the land before planting an apple orchard is of the greatest importance, for any lack of preparation before planting can hardly be remedied after the trees are set. If one does not intend to prepare the land well, manure well and cultivate well, he had better let the planting of an orchard alone, for there can be no profit in apple trees treated as the great majority of them are in this State. The chief point in the preparation of the land is deep plowing of the soil. This is especially needed on our red-clay uplands, where trees set in shallow plowing are so apt to be stunted by droughts. The land for the orchard should be prepared early in the fall, by plowing as deeply as a pair of horses can pull a plow and behind this team another team in same furrow, with a subsoil plow to break the clay still deeper, till the whole land is broken to a depth of 15 inches. This deep preparation will be the best investment the planter can make in setting the orchard.

HOW FAR APART TO PLANT TREES.

If there was any probability that the owner would have the nerve to take out half the trees when they get too thick, we would advocate the first planting in this climate to be at twenty feet apart each way, so as to get the benefit of the shade as soon as possible. But for the mature trees this would be just twice as close each way as they should be. Hence it is better, as a rule, to plant at once as we want them to stand—That is for most apples, 40 feet apart each way. This will give but 27 trees to the acre. If the trees are planted alternately in adjoining rows, 35 feet will give abundant room. In most of our hilly land there will be an advantage in setting the trees just as we plant other crops—on the level of the hill, following the contour lines around the elevation. Planted in this way, the terraces could be made to correspond with the tree rows and the trees be planted on the terrace banks. There would be the additional advantage, in this, that the apple tree, being fond of moisture, would have the best chance there, as the terrace banks would hold back the water and the roots of the trees would have the advantage of the increased moisture soaking into the land above them. Planted in this way 35 feet between the trees and terraces would be an abundance of room.

When to Plant.

In this climate all hardy trees of a deciduous character should be planted in fall as soon as possible after the fall of the leaf. Our soil never freezes deeply in winter, and the trees will be renewing their feeding roots during the winter, and will thus be ready to grow off rapidly in the spring.

How to Plant a Tree.

When trees are dug from the nursery, no matter how carefully the digging is done, the roots are more or less mutilated. The small fibrous roots, on which the root hairs are, and through which the tree draws its food from the soil, are all dried up inevitably, and the newly-planted tree must make new fibres before it can draw food from the soil. If all the roots are planted the process of making root fibres will be much slower than if the roots are properly pruned. Therefore in preparing the tree for planting, the small dried fibres should all be cut away, and all the roots pruned back to a few inches in length with a sharp knife, making a clean sloping cut on the under side. From this cut surface the new fibres will push readily in the moist soil. If the land has been properly plowed and subsoiled there is no need for the making of extra large and deep holes. But in setting the tree the earth should be, if possible, rather on the dry side than wet, for it is hard to set a tree properly in wet soil. The chief point to observe in planting is to get the earth closely packed about the roots. This can best be done by using a small sized rammer and then ram the earth as it is being put in, as tight as though setting a fence post. Never pour water into a hole in planting a tree, as the effect of this is to bake the soil and cause cracks to form, that let the air into the roots and so defeat the very object of putting the water there. Never either put any decomposing manure in contact with the roots, as this too, does more harm than good, by causing the soil to dry and to encourage fungus growths. Good surface soil is all that is needed about the roots, and any manure that is to be used, should be put on top the soil as a mulch. Used in this way the manure is very important in preserving moisture and feeding the tree.

LAYING OFF THE ROWS.

Most farmers simply run out the rows and then cross them with a plow. When well done, by a good plowman, the trees can, in this way, be planted in comparatively good order. But whatever is worth doing at all, is worth doing well. The orchard looks better if all the rows are mathematically straight. Hence we prefer to set the stakes at the end of the lines with the compass, and then in planting, stretch a wire from end to end, and on this wire have pieces of red cloth fastened where every tree is to come. If the outside rows are run exactly with the compass this method will insure perfectly straight rows, as the wire does not stretch like a line is apt to.

PRUNING THE TOPS.

The great difficulty in planting trees of apples that are two or three years old, is that the tops have been, to some extent, formed in the nursery, and generally too high for our climate. The nurseryman is not to be blamed for this, for buyers generally insist on tall trees and the nurseryman must supply what people want. Hence we prefer to plant good one-year-old trees that are simply switches, with few or no branches. Trees of this age have plenty of well-developed buds all along the stem, and there is no difficulty in starting the head where wanted. Having trees of this character, we would, as soon as planted, go over and cut them all back to about twenty inches from the ground. When the growth starts, we select the buds that are to form the head—three or four nearest the top—and then rub off, and keep rubbed off, all other growth below them. The future of the tree depends very largely on the pruning of the first few years. During these years the head is formed and shaped, and it should be done properly, so that little pruning will be needed as the tree approaches maturity.

PRUNING THE GROWING TREE.

During the first season's growth there will be no need for the knife if the owner keeps his eyes on the trees and stops with finger and thumb any growth starting where it is not wanted. This is far better than letting branches grow and sap the strength of the tree all summer, to cut away in the fall, when the same growth could have been directed into the proper channel by a little care and attention. The fall of the first season, that is, the first fall after the trees are planted, they should have a proper pruning as soon as the leaves fall. There is a right and wrong way to make every cut in pruning a tree, and the pruner should know what he wishes to produce by making a cut. Some varieties are inclined to grow too erect, while others are inclined to be of too drooping and spreading a character. These should be pruned differently.

When we want to make the head more spreading we prune to bud on the outside of the limb, and when we want to correct the spreading habit the shoot is pruned to a bud on the inside of the limb. In general we will find that this first fall pruning should be to shorten back the growth of the summer one-third or more, so as to encourage a proper branching of the head. Cut out shoots that interfere with each other and those that tend to thicken up the centre of the tree too much. What are known as water-sprouts in the centre of the tree are an evidence of neglect. There will never be any water-sprouts if the owner watches the trees during the summer and rubs them off as they appear. If the trees are watched well during the summer, there will seldom be need for pruning of limbs of much size in the fall. The subsequent treatment of the trees at the fall prunings should be directed to the preservation of a round and open head, and to keep the growth well balanced on all sides.

CULTIVATION OF APPLE ORCHARDS.

During all the early years of the life of the orchard the thing most needed is a good healthy growth. To encourage this well developed growth, good cultivation is important. We will assume that the planter of an orchard means to devote it to the production of fruit alone. If you mean to crop the land in grain or grass for harvesting and sale, you had just as well abandon the idea of fruit, and had better not plant the orchard. During the time while the trees are small, there are some hoed crops that can be well grown in it to pay for the expense of cultivation. Corn is too tall a crop and too long on the ground. Low-growing garden vegetables are far better, especially those that come off the ground in early and mid-summer, for the cultivation of an orchard should cease by the first of July, so that the growth of the season can be properly ripened. At this time the orchard should be sown in peas, and the peas should be allowed to die on the land for a soil cover during the winter, and to be plowed under in the spring, and the cultivation renewed. This cultivation till July, and sowing in peas, should be kept up till the trees have made growth enough to be getting into bearing shape. Then a check to the rapid growth will tend to the formation of fruit spurs and fruit bearing. This, with most varieties will be when about seven to eight years old. We would then seed the land down to grass, using a mixture of orchard grass, red top and Kentucky Blue Grass. The whole surface of the soil should be put in the best possible order before sowing the grass seed, for it should be in condition to run the mower over it frequently. As fast as the grass gets tall enough run the mower through the orchard, and let the cut grass lie to decay and form a mulch over the whole land. This mowing should be so frequent that there will not be too heavy a mass left to decay. This formation of a cushion-like mass of grass under the trees has many advantages. The apples that fall from the trees are saved in condition to use as they are not bruised. The roots are encouraged to ramble near the surface where they are in the best soil, and in reach of the manures added to the land.

Do Not Pasture the Orchard.

If you intend to turn stock into the orchard to pasture on the grass, you will defeat the very object for which the grass is used. If you cannot resist the temptation to pasture the land you had better not put it in grass, but keep on with the cultivation. The proper keeping of the land in grass is not any cheaper than the cultivation, but is far better for the trees and the fruit. But putting an orchard in grass and then turning stock into it is not proper grass culture in the orchard. It is true that hogs, with noses jewelled to prevent rooting, may at times be allowed in the orchard to gather the wormy fruit, but nothing further than this should be attempted.

Manuring the Orchard.

During the early years of the tree's life there is no particular objection to the use of stable manure on the orchard, for growth is then what is wanted. But after the trees are well developed there will be an abundance of nitrogenous matter from the plowing under of the peas annually. The perfection of a hard-wooded fruit tree, like the apple, demands plenty of the mineral plant foods in the soil. Hence the chief needs will be phosphoric acid and potash. The growth of the tree itself takes large amounts of these, and when the fruiting begins the carrying off of potash in the fruit crop is very heavy, much heavier than in the case of grain fields. Farmers readily see the necessity for fertilizing a wheat field, but can, with difficulty, be made to understand that a crop of apples robs the soil of far more mineral matters than the wheat crop does. As we have shown, where there are plenty of hard-wood ashes available at a reasonable price, there is no better application that can be made to an orchard. Raw-bone meal is also an excellent dressing for the orchard, and the best application probably that can be used as an annual dressing is 400 pounds per acre of equal parts of bone meal and kainit.

General Treatment.

When the orchard has gotten into bearing and is properly kept fertile, and the grass sod is allowed to accumulate and grow dense by the decay of the cut grass, there will be little left to do except to guard against insect enemies and fungus diseases. Pruning will rarely be needed if the trees have been properly attended to in the early stages of growth. Of course the same watchfulness must be used to prevent the growth of water sprouts in the centre of the trees and the growth of suckers around them. But if these are pinched out at the right time there will be none to cut out in the fall.

What Varieties of Apples Shall we Plant?

This is about the first question a man is apt to ask when about to plant an orchard, and it is about the hardest one to answer for all localities. If the orchard is designed merely for family use, then one will want a greater variety than if it is intended for growing apples for market. The great fault in all of our best apple section is that they grow varietiee that do not meet a ready sale on a critical market. Apples like the Red Limbertwig are certain bearers and heavy bearers, but people do not want them when they can get better apples, and their dingy color is against them. True, the market will take a very inferior apple, like the Ben Davis, when it is handsome and a good keeper, and Ben Davis being both, has come to be grown more largely than most other apples. The grower for family use puts quality first, while the market grower puts appearance, productiveness and keeping qualities first. Market growers must grow what the market wants, no matter whether we like it or not. Our mountain people grow Red Limbertwigs and Buffs and then try to make the markets take them, which can only be done when there are no good apples to be had. The following list comprises only those that have been found adapted to the State.

Summer Apples.

Carolina Red June.—A bright red and handsome apple, and salable as a market fruit.

Early Harvest.—Larger than the last, and bright yellow in color. One of the best.

Hames.—A large and fine looking Georgia apple, ripening among the earliest.

Red Astrakan.—Large, deep red, and one of the most salable early apples.

May Yellow.—The earliest apple grown. Small in size and yellow in color.

Hunge.—One of the finest late summer or early autumn apples.

Horse.—One of the most popular late summer apples in all parts of the State.

Yellow Transparent.—This yellow apple promises to be the leading early apple. It is of good size and quality, and is one of the earliest bearers. The trees being naturally of small size, makes it valuable for small home grounds.

Summer Pearmain.—One of the finest quality of apples of its season. Ripe in August and very good indeed.

FALL APPLES.

Bonum.—Known all over the State as Magnum Bonum, but the rules of the American Pomological Society have cut it shorter as to name. Mr. T. T. Lyons, a noted fruit-grower of Michigan, once said to the writer: "Your North Carolina Bonum apple is the best fall apple in the United States." While we did not fully agree with him, we do consider the Bonum as one of the best fall apples, and one better suited to all parts of the State than any other apple.

Buckingham.—A very large and showy apple, and of good quality, ripening in September.

Carolina Beauty.—An apple of fine quality, which originated in the eastern part of this State, and hence may be expected to do well in that section.

Rome Beauty.—A showy, late fall or early winter apple of medium quality, but one that will sell on account of its bright color.

Hoover.—A large, very dark red apple of good quality, ripe in September.

WINTER APPLES.

Paragon, or Arkansas Mammoth Black.—An apple of large size and showy appearance, which promises to be one of the best for the western section of the State.

Albemarle Pippin.—We only mention this noted apple here to say that it succeeds well in the mountain coves of the western part of the State, but is worthless elsewhere. Where it succeeds there is no finer apple, either for home or market.

Ben Davis.—This is one of the most showy apples, and the tree is a regular bearer everywhere and sells well, but in our opinion it is about as poor an apple as can be grown, and we do not advise it for family use. It is now being so largely grown that its inferior quality must soon become familiar to all buyers, and we do not advise its planting in large numbers, even for market. Its redeeming quality is that it will give apples of showy appearance when all others fail.

McCuller's Winter.—This promises to be one of the best apples for the sandy lands of the eastern part of the State.

Edwards.—This is a seedling of the Hall, and twice as large as that variety and fully as good and as good a keeper.

Mattamuskeet.—This apple originated in the peaty lands of the coast section, and is only suited to that region, where it is one of the best of winter apples.

Nansemond Beauty.—A Virginia apple that does well in this State. Season, early winter here.

Royal Limbertwig.—A great improvement on the old Red Limbertwig. A good keeper and a fairly good apple.

Winesap.—One of the very best winter apples, and one of the most salable. There is a new variety known as Stayman's Winesap, which is claimed to be a great improvement on the old one. I have not grown this, but have grown the old Winesap, and it is as good as any I have ever tried.

York Imperial.—This is one of the best keepers and a showy apple, and is taking high rank as a shipping apple. It has been called erroneously by some Johnson's Fine Winter apple, but the foregoing is its true name. This and the Winesap are about the best market apples that can be grown here.

Pine Stump.—This is a very fine flavored late fall or early winter apple, but is not a late keeper. Its fine quality will sell it at any time.

Van Hoy.—A Forsyth county apple that is highly esteemed by those who have grown it and is considered to be one of the best large winter apples.

Yates.—A small sized Georgia apple, of fine quality and good keeping character. It is a good heavy bearer.

FOR EASTERN NORTH CAROLINA.

The following are particularly recommended as winter apples: Ben Davis, Edwards, McCuller's, Mattamuskeet, Pine Stump and Yates.

FOR MIDLAND NORTH CAROLINA.

Arkansas Mammoth Black, Ben Davis, Royal Limbertwig, Edwards, McCuller's, Van Hoy, Winesap, Nansemond Beauty, Pine Stump and York Imperial.

FOR WESTERN NORTH CAROLINA.

Any of the list except the Mattamuskeet.

CRAB APPLES.

Crab apples are very ornamental as trees, and the fruit is useful for preserves and jelly and for cider. The best preserving sorts are the Red and the Yellow Siberian and Transcendant, while for cider making the Hughes's Virginia Crab, Waugh's Crab and Jones's Cider are the best.

GATHERING AND MARKETING APPLES.

There is no one point in apple-orcharding in which there is so general a need for information as in the gathering and handling of the apple crop. The practice of the growers in the best apple sections of the State in handling their apples is simply ruinous to their profitable sale. Shaking the apples from the trees and gathering them from the ground, and then dumping them in bulk into the body of a springless wagon to sell to dealers in the mountain towns is a common practice. And when the dealers get hold of them they dump them loosely into large crates, and ship them to the towns of the Eastern part of the State, where they usually arrive bruised and worthless, and the shippers wonder why North Carolina apples do not sell in competition with the Northern fruit. Apples of all sizes and colors, good and bad, knotty and perfect, are dumped into the same receptacle, a crate not fit to ship apples in at all, and the only wonder is that they bring anything at all. And they do bring very little when good fruit is abundant. Go to a groceryman in Raleigh and price apples, and he will say: "Here are some good Northern apples for so much, and here are some stuff from the mountains of North Carolina, which you can have for half price or less." And the difference in the price is not because the apples from the mountains are inferior sorts to the others, though there are usually too many poor Limbertwigs among them—but because of the condition of the fruit. The Northern apples are handled and shipped by men who know how to pack and handle apples and they come to hand in good condition. They are properly culled and the barrel has in it but one variety of apple and the name is branded on the barrel, for they are not shipped in crates to be cut and bruised for lack of tight packing.

How to Gather Apples.

Never shake the fruit from the tree and never pack for market any apples that have fallen from the tree. Gather every apple by hand and place it carefully in a basket. The apple growers North use ladders, made on the place, of a light pine pole split some distance from the butt end, and rungs stuck in to keep the lower end apart, while the entire upper part is but a single pole with rungs stuck through. This kind of a ladder can be stuck in anywhere on the tree and makes it possible to reach all the apples. It is simply like a long wagon pole with rungs stuck through. The gatherer takes a light basket and lets it down by a rope when full. The barrels are taken into the orchard and packed right there. The name of the apple is marked on the bottom of the barrel, which is to be the top when opened. A layer of apples is then placed, stem down, on the bottom, all over so as to make a good appearance when opened, but the same quality must run all through the barrel. The apples are then poured carefully into the barrel, which is shaken gently to settle them and the barrel is filled a little above the top. The head is now laid on and with a screw press it is forced in, and the apples are then perfectly tight. The hoops are driven down tight and head linings nailed in place and when that barrel is opened after long journeyings it will be found with the imprint of the head on the upper layer of fruit, showing that no apple has moved. This tight packing is not possible in a slatted crate made of laths such as are sent to Raleigh from the Western part of the State.

KEEPING WINTER APPLES.

The process just described for packing for market is the best that can be devised for keeping the apples. Apples that are to be kept for home use will keep better tightly packed in the barrels in the orchard as fast as gathered. If not sold at once, pile the barrels on their sides in a cool, airy place under shelter, and as the weather gets colder put them in a tight house, on their sides, with a thick layer of straw under them, and, in very cold snaps, a thick layer over them. This will keep them in any weather we have if in a close building, for it takes a very low temperature to freeze an apple packed in a close barrel and sheltered. There is more danger of keeping them too warm than too cold. Just at or a little above the freezing point of water will keep them all right.

Tight barrels, tightly packed, are the only packages fit for winter apples, and any attempt to ventilate the barrels is worse than useless. Never ship them in lath crates if the fruit is expected to sell well.

FUNGUS DISEASES OF THE APPLE.

Bitter Rot or Ripe Rot.—This is a disease that is peculiarly prevalent in apple orchards in the South. It breaks down the tissues of the fruit at any time during its growth, and is more common on the summer than on winter apples. It usually appears as black pimples and they make the fruit exceedingly bitter to the taste. The best remedy that has been tried is to spray the trees with Bordeaux mixture four times, beginning before the leaves expand, then just after the apples set, and the third time two weeks later and the fourth time four weeks after the last.

Powdery Mildew.—This is another disease very common in the South. It attacks the young foliage, giving it a greyish appearance, and is particularly bad on young nursery trees that are intended to be budded, retarding their growth and rendering the plant unthrifty and not fit to work. The remedy recommended by the Department at Washington is to spray the trees with the ammoniacal solution of copper carbonate, beginnig when the leaves are one-third grown and apply it five times thereafter at intervals of ten or twelve days.

Rust.—This is one of the fungus plants that puzzled botanists for a long time, until we realized that there are many of this class of plants which affect two different plants at different seasons of the year, one being the host plant for the winter spores and the other for the summer ones. In the case of the rust of the apple the winter host plant of the fungus is the common cedar tree, Juniperus Virginiana. Every one knows the so-called cedar apples that infest the cedar trees, and we have all seen how, in spring they send out long worm-like masses all over the outside of the knot or apple. On these soft yellow worm-like bodies the spores or reproductive bodies are borne, and from them they fly off in the air. But they cannot grow on the cedar, but only on the leaves of the apple or on the fruit. When once the cedar has thus infected an apple tree, the vegetative part of the fungus may remain there for years in the buds and branches, and the rust may appear year after year, though the cedars have been taken away. The foliage becomes covered with yellow spots and loses its power to aid in the growth of the tree, and the perfection of the fruit, and at times the tree loses its leaves entirely, and the fruit is ruined. Rust is a hard disease to combat. The best thing is to destroy all cedar trees from anywhere near the site of a young apple orchard, or at least keep the cedar apples cut out and burned. In case this is not practicable from the abundance of the cedar trees, then the best plan is to spray frequently with Bordeaux mixture to kill the fungus as it appears on the leaves. Some varieties of the apple seem to resist the rust better than others, and where cedars are abundant the resistant sorts should be planted.

Scab.—Scabby apples and pears are so common that every one is familiar with their appearance. Both leaves and fruit are attacked, the fungus forming dark circular spots, almost black in the centre, with a lighter or greyish rim. On the fruit, the fungus forms deep scabs and cracks, and the growth on the side attacked is checked so that the apple becomes one-sided. The light colored edge is more apparent on the fruit than on the leaves. The amount of damage done by the scab fungus in all parts of the country is immense. The leaves become diseased so that they cannot perform their functions, and the market value of the fruit is impaired, and finally the health of the entire tree is so damaged that it becomes worthless. The remedy is the regular use of the Bordeaux mixture. The first application should be made before the blossoms open in the spring, or even before the buds swell, and another just before the opening of the flower, followed by a third, as soon as the blossoms fall. On some resistant varieties, these two applications will be sufficient, but on others it will be better to give another spraying a week or ten days later.

INSECT ENEMIES OF THE APPLE.

Aphis, *or Leaf Louse.*—During the past season of 1897, the apple nurseries of North Carolina were badly infested with the Aphides. In examining the nurseries last autumn for the Commission for Controlling Crop Pests I was struck with the difference in the growth of the young apple trees in two nurseries near each other. In one nursery nothing was done to check the lice, and the growth was seriously checked before they finally disappeared for the season. In the other nursery the proprietor, by my advice, sprayed the trees with a strong infusion of tobacco and cleared them off at an earlier period, and his trees showed the advantage in their superior growth. While the apple-leaf aphis will disappear as the weather gets hot, it is always better to spray and destroy them. A strong tea should be made from the stems of tobacco, and this should be sprayed over the trees; or the refuse dust from the smoking-tobacco factories can be dusted on the trees with a powder bellows. On bearing orchards it is seldom necessary to spray for the aphis, but young nursery trees should be kept free from them if a fine growth is to be expected.

Root Aphis, or Grey Plant Louse Wooly Aphis.—This is one of the worst pests the Southern apple nurseryman has to contend with. Thousands of young trees are annually destroyed by them. The insect does not appear to be known northward, as no Northern writer mentions them. But here they kill annually an immense number of trees. If a young tree when received from the nursery shows any signs of the aphis on the roots they should be dipped in strong kerosene emulsion before planting. In the nursery the only remedy is to inject a teaspoonful of bi-sulphide of carbon into the soil near the base of each tree a rather troublesome and expensive process, but an effectual one.

Borers.—The apple-tree borers are of two kinds, the flat and the round-headed ones, the larvæ of Chrysobothris femorata and of Saperda candida and S. cretata. The only way to attack these is to watch for their appearance on the stem or the base of the tree and cut them out or run a wire into the burro wto kill the larvæ. Constant watchfulness is the only means for keeping them in check, and if let alone they will soon destroy the trees or seriously damage them.

Bud Moth.—Last autumn we noticed many nursery trees that had their terminal buds destroyed by the bud moth, the larvæ of which had eaten the growing bud. Northward it is said that there is but one brood of these in a season, but from the stage of development of those found in September last it is evident that here there must be two broods. Spraying with arsenical poisons will destroy them, and on orchard trees it is easy to add a quarter of a pound of Paris green to a cask of the Bordeaux mixture used for fungus spraying, and this will be effectual against this and the worse enemy to the Codlin moth. But never spray trees with poisons while they are in bloom, as the bees are then at work and will be destroyed, and the spraying may injure the setting of the blossoms.

Canker, or Measuring Worm.—This insect is not a bad one in the South as northward, and it can be destroyed in the same way as the last

Codlin Moth.—This insect, the great cause of wormy apples, is one of the worst foes of the apple-grower, and one which has thriven on the general neglect with which our orchards are treated. The moth is greyish brown and has transverse streaks of grey and brown on its forewings, and on the inner hind angle a large brown spot like a horse shoe. The hind wings are light brown. The moths lay their eggs at the blossom end of the forming apples in the blossoms. The eggs soon hatch and the larvæ eat into the apple, and in about six weeks a second brood of moths appears, followed by one or two more broods during the season. The eggs are laid not only on the fruit but also on the leaves of the tree. The best remedy is the spraying with Paris green, making the first spray as soon as the blossoms fall. Another spraying should be made ten days later. There should be no delay in the first application, as the larvæ cannot be reached when it has once eaten into the apple, and must have the poison for its first meal. If we succeed in killing all the first brood there will be no second, but the regular spraying with Bordeaux mixture used for the fungus diseases will meet all the broods as they come, if the Paris green is added to it. There are some insects that are killed by the Bordeaux mixture itself, but it must be remembered that it is mainly used to destroy fungi, and that for insects the arsenical poisons must be added. Then, too, there is some fungicidal value in the Paris green too. It has been stated that no harm is done to animals grazing in the orchard by the use of these spraying materials. But, as we have said, the orchard should not be made a pasture of, and if the poisons render their pasturing dangerous so much the better for the trees.

Curculio.—The little rough-backed beetle, that punctures the plums so badly, does not confine his attention to plums, by any means, for no fruit comes amiss to the "little turk." The apple curculio, however, is a different, though closely allied species to, the plum curculio. Both the apple and peach are badly infested in the South with curculios. The same spraying that is recommended for the Codlin moth will answer just as well for the Curculio.

Oyster Shell Bark Louse, or Scale.—This is the most wide-spread and destructive insect that infest the apple orchards of this State. In my travel through the mountain section of the State, I could hardly find an orchard tree that was not infested, and in the general neglect of orchards in this State the louse has so increased as to threaten the destruction of orchards in the best apple-growing section. The insidious character of this scale has prevented its ravages being noted, but lately the scare about the San Jose scale has set the people to watching their trees, and I have received innumerable samples of the apple-tree-bark louse, with the inquiry if it was the San Jose scale. I believe it really harder to get rid of than the San Jose scale. The insect sticks closely to the bark, and is protected by a thick scale, which applications to the mature scales will not penetrate. Under the magnifying glass the scales resemble oyster shells, hence its name. If a tree is badly infested the best plan is to head the limbs back well and burn all the brush, then apply a good thick coat of whitewash to the whole trunk and limbs. In fact this old-fashioned plan of whitewashing apple trees is one of the best things that can be done for the orchard, as it cleans off fungus growths and insects and benefits the growth of the trees. The only time when the scales can be destroyed by spraying is in the spring when the young insects are coming out from under the old scales. This, here, is usually in early April. If the trees are then well sprayed with kerosene emulsion, the young will be killed, and the old ones will soon pass away. There is a fungus that is destroying some of the scale insects, which we trust will soon attack this one. On some maples that were badly infested with the gloomy scale this fungus has about finished the lot. Our apple-growers in the western part of the State need to give earnest attention to the scales, as they are losing daily by neglect.

Tent Caterpillar.—There is no sight more common here than to see apple trees with the nests or webs of the tent-caterpillar on them. The eggs from which these are hatched are laid by a brown moth about three-fourths of an inch long on the twigs of the trees about the first of July or earlier. These eggs remain there till the following spring, and then hatch, and the young caterpillars begin to feed on the leaves and soon spin in their web. Later in the season they make cocoons and are soon transformed into moths, which lay eggs for the next brood. The nests may be burned or the foliage sprayed with arsenites and the insects easily killed. Trees that are sprayed for the Codlin moth will never be troubled with the tent caterpillars. The great breeding places of these insects are the wild-cherry trees, and as these are seldom disturbed they breed enough to stock the whole neighborhood. The wild cherries should be kept clear or destroyed about the apple orchard.

Composition of Spraying Mixtures.

We have advised several mixtures for spraying trees for warding off fungi and insects. The following formulas will enable the grower to make them.

Bordeaux Mixture.—This is the main reliance as a fungicide remedy. Copper Sulphate, 6 lbs., dissolved in warm rain water; 4 lbs. of fresh lime, slaked as for whitewash. Strain the lime-wash into the copper solution and add 45 gallons of water. When the spraying is done before the leaves and buds start, half this quantity of water is enough, but for use after the growth has started the full amount of water should be added. For killing the Codlin moth and other insects, as advised, mix with an oil cask full of the Bordeaux mixture one-fourth pound of Paris green, and keep it well stirred while using. A spraying pump of some description is needed, and for trees it is better to have one of large size mounted on wheels rather than attempt to spray with the knapsack machines, which are only useful on a small scale.

Ammoniacal Carbonate of Copper Solution.—This has been put up under the name of "Copperdine," and in this shape is better for the ordinary grower than for him to attempt to make it himself.

Kerosene Emulsion.—Dissolve half a pound of hard soap (home-made soap made with with ashes is better than soda soap) in one gallon of boiling water. Then add two gallons of kerosene, then churn it till the oils, soap and water unite in an emulsion. It is necessary to use very soft rain water. After the emulsion is made, add twenty gallons of soft water before using. If a hot decoction of tobacco stems is used instead of the simple water it will be more effectual against the Aphides or plant-lice.

Medicinal Plants

WHICH HAVE BEEN COLLECTED AND USED IN NORTH CAROLINA.

ISSUED BY
THE NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION,
RALEIGH, N. C.

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NORTH CAROLINA COLLEGE OF AGRICULTURE AND MECHANIC ARTS,

RALEIGH, N. C.

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The Station is glad to receive any inquiries on agricultural subjects. *Address all communications to the Agricultural Experiment Station, and not to individuals.* **They will be referred to the members of the Station staff most competent to answer them.**

INTRODUCTION.

The rich flora of North Carolina has made the State a favorite field for botanical exploration from the earliest settlement of the country, and the collection and sale of medicinal herbs has long been practiced on a scale larger than in any other State. We have thought that a catalogue of the plants that have reputed medicinal virtues, and which are either native to the State or have become so naturalized as to be esteemed native plants, would be useful as a matter of record.

It must not be understood, however, that the publication is in anyway an endorsement of the medical value of any. Many of the plants named are the sources of regular officinal preparations, and many are of doubtful value, but are largely collected and used by the manufacturers of the "Patent Medicines" and the so-called "Sarsaparillas," and quite a large trade has sprung up in these things. But it is by no means the intention of the Station to prepare a Pharmacopœa, or to prescribe how the various plants are used as medicines. In fact we would discourage the domestic dosing with herbs, the effects of which are not well known. People are too much inclined to dose themselves with everything that is recommended without knowing whether the article has value or not, and without knowing whether its effects are needed by the patient. When one needs medicine of any kind it should be taken only under the advice of an educated physician and not that of an "herb doctor."

Hence we make the publication simply as a matter of record, without any endorsement of the reputed virtues of the plants which have been taken from the published statements.

In regard to the nomenclature, we have followed largely the recent changes in names that have been made by Professor Britton, though we must confess that in many of the cases we can see no good reason for the change, even under botanical rules of priority. Whether we will continue to adhere to many of these names we think is doubtful. My own time being fully taken up with other work this has been done entirely by Mr. Hyams, under my supervision.

We trust that the bulletin may be found useful as a record.

W. F. MASSEY, *Botanist.*

MEDICINAL PLANTS IN NORTH CAROLINA.

By C. W. HYAMS, Assistant Botanist.

ORDER I.

RANUNCULACCEÆ. (CROWFOOT FAMILY.)

Clematis Virginiana, L. VIRGIN'S BOWER.

The leaves and flowers have an acrid, burning taste, and when bruised they irritate the eyes and throat, giving rise to a flow of tears and to coughing.

Clematis Crispa, L. MARSH CLEMATIS.

The leaves and flowers are res., acr., irr., diu.

Clematis Viorna, L. LEATHER-FLOWER.

The leaves and flowers are acr., res., sti., diu., sed.

Clematis Ochroleuca, Ait. SILKY CLEMATIS.

This plant is used for the same purposes as the above and is often sold for it in the shops.

Clematis Addisonii, Britton. ADDISON BROWN'S CLEMATIS.

The bruised roots and leaves are supposed to cure itch when applied to the surface, as an infusion. The seeds are doubtless equally efficient.

Anemone Caroliniana, Walt. CAROLINA ANEMONE.

The herb has bitter, tonic properties.

Anemone Quinquefolia, L. WINDFLOWER.

The flower is acrid, corrosive, poisonous, and rubifacient. Acts as a poison to cattle, producing bloody urine and convulsions.

Anemone Trifolia, L. MOUNTAIN ANEMONE.

This plant has similar qualities to the above. Large numbers of cattle die from eating it in our mountains every year. Poisonous.

Anemone Virginiana, L. TALL ANEMONE.

The herb is caustic, and has the properties of the other species to some extent.

Hepatica Hepatica, L., Karst. LIVERWORT, KIDNEY LIVERLEAF.

The whole plant is used and has a mucilagenous, somewhat astringent, bitter taste. It is a mild, demulcent tonic and astringent and is supposed to possess diuretic, deobstruent properties.

Hepatica acuta, Parsh, Britton. SHARP-LOBED OR HEART LIVERLEAF.

Used for same purposes as the above. Both are collected and sold in the shops for the same plant and no distinction is made where required for medicinal uses.

Thalictrum dioicum, L. EARLY MOUNTAIN RUE.

The roots are purgative and diuretic.

Thalictrum clavatum, D. C. MOUNTAIN MEADOW RUE.

Thalictrum coriaceum, Britton, Small. THICK-LEAVED MOUNTAIN RUE.

Thalictrum purpurascens, L. PURPLE MOUNTAIN RUE.

Thalictrum polyganum, Muhl. TALL MOUNTAIN RUE.

All of the above possess similar virtues.

Syndesmon thalictroides, L., Hoffing. RUE ANEMONE.

The root is purgative and diuretic.

Trautvettaria Carolinensis, Walt., Vail. FALSE BUGBANE.

The roots are collected and sold in the shops as *Cimicifuga racemosa*, to which they bear a very close resemblance.

Adonis annua, L. PHEASANT'S EYE.

Commonly cultivated for ornament, but has escaped into waste places. The plant has bitter, astringent properties.

Adonis vernalis, L. FALSE HELLEBORE.

This is a handsome perennial from Europe and has escaped from cultivation in some localities. The herb possesses caustic, vesicant properties.

Ranunculus bulbosus, L. BULBOUS BUTTERCUPS.

The plant is acid, narcotic, rubifacient, and counter-irritant. When swallowed in the fresh state, any of these plants will produce heat and pain the stomach, and if the quantity is large, may excite fatal inflammation. They have been generally used by physicians for inflaming and vesicating the skin, but owing to the uncertainty and violence of their action, have been banished from regular practice, and should never be used unless under the direction of a physician.

Ranunculus abortivus, L. CHICKEN PEPPER, KIDNEY-LEAVED CROWFOOT.

Ranunculus delphinifolius, Torr. YELLOW WATER CROWFOOT.

Ranunculus pusillus, Poir. LOW SPEARWORT.

Ranunculus Alleghaniensis, Britton. MOUNTAIN CROWFOOT.

Ranunculus scleratus L. CELERY-LEAVED OR DITCH CROWFOOT.

Ranunculus recurvatus, Poir. HOOKED CROWFOOT.

Rannnculus acris, L. TALL OR MEADOW BUTTERCUP.

Ranunculus Pennsylvanicus, Lf. BRISTLY BUTTERCUP.

Ranunculus repens, L. CREEPING BUTTERCUP.

Ranunculus hispidus, Mich. HISPID BUTTERCUP.

Ranunculus fascicularis, Muhl. EARLY OR TUFTED BUTTERCUP.

Ranunculus parvulus, L. HAIRY BUTTERCUP.

Ranunculus parviflorus, L. SMALL-FLOWERED CROWFOOT.

Ranunculus muricatus, L. SPINEY-FRUITED CROWFOOT.

Ranunculus obtusiusculus, Raf. WATER PLANTAIN SPEARWORT.

Ranunculus Purshii, Richardson. RICHARDSON'S CROWFOOT.

Ranunculus Aquatilis, L. WATER CROWFOOT.

Ranunculus palmatus, Ell. POLLEN-LEAFED CROWFOOT.

All of the above are analogous to *Ranunculus bulbosa*, and none of them should be used in local practice by inexperienced people, nor should they ever be taken internally.

Caltha palustris, L. MARSH-MARIGOLD, MEADOW-GOWAN.

This plant is expectorant and pectoral.

Xanthorrhiza apiifolia, L'Her. SHRUB YELLOW-ROOT.

Is a simple tonic, bitter. This plant possesses properties closely analogous to columbo, quassia, and other simple tonic bitters.

Aquilegia Canadensis, L. WILD COLUMBINE.

All parts of this plant have been employed medicinally. The root, leaves, flowers, and seeds have a bitterish, acrid, disagreeable taste and odor. It has been considered diuretic, diaphoretic, antiscorbutic, sodorific, tonic, and emmenagogue. Doubtless possesses dangerous properties like the other Ranunculaceæ.

Aquilegia vulgaris, L. EUROPEAN COLUMBINE.

Has escaped from cultivation in some sections.

Delphinium Consolida, L. FIELD OR GARDEN LARKSPUR.

The root, flowers, and seed are poisonous, diuretic, emmenagogue, vulnerary, vermifuge, and insecticide. The flowers having been formerly supposed to possess the power of healing wounds, gave the name *consolida* to the species. The seeds are very acrid, are said to be diuretic, and in large doses produce vomiting and purging.

Delphinium arceolatum, Jacq. TALL LARKSPUR.

Delphinium Carolinianum, Walt. CAROLINA LARKSPUR.

Delphinium tricorne, Michx. DWARF LARKSPUR.

All of the above have analogous properties. Cattle have been known to die in our mountains after eating this last variety.

Aconitum uncinatum, L. MONKSHORD, ACONITE.

Is a powerful poison and should only be used when prescribed by a regular physician.

Aconitum reclinatum, Gray. TRAILING WOLFSBANE.

This plant is also a dangerous poison, with similar properties to the other *aconites*, and is collected and sold as the above.

Cimicifuga racemosa, L., Nutt. BLACK COHOSH OR SNAKEROOT.

The effects of this plant in health has not been fully investigated.

Cimicifuga cordifolia, Parsh. HEART-LEAVED SNAKEROOT.

Cimicifuga Americana, Michx. AMERICAN BUGBANE.

Both of these have properties similar to the *racemosa*, and are collected and sold in the shops for it.

Actæa alba, L., Mill. WHITE COHOSH OR BANEBERRY.

The root is an active emetic and violent purgative.

Actæa rubra, Alt., Willd. RED COHOSH OR BANEBERRY.

Emmenagogue properties have been ascribed to the roots of this plant, but like the above it is an active purgative and should be used very cautiously.

Hydrastis Canadensis, L. GOLDEN SEAL, ORANGEROOT.

The powers claimed for this plant are very diversified. All admit its tonic properties, and some claim it to be aperient, alterative in its influence on the mucous membranes, cholagogue, deobstruent in reference to the glands, diuretic, antiseptic, etc.

Pæonia officinalis. GARDEN PÆONY.

This plant is to be found in most of our flower gardens, but has not escaped from cultivation. The root is said to possess decided nervine powers. The seeds are said to be emetic, purgative, and anti-spasmodic. All of the different varieties of this plant have similar properties.

ORDER 2.

MAGNOLIACEÆ. (MAGNOLIA FAMILY.)

Magnolia Fraseri, Walt. FRASER'S MAGNOLIA. EAR-LEAVED UMBRELLA TREE.

Magnolia macrophylla, Michx. GREAT-LEAVED MAGNOLIA OR CUCUMBER TREE.

Magnolia tripetala, L. UMBRELLA-TREE. ELKWOOD.

Magnolia acuminata, L. MOUNTAIN MAGNOLIA.

Magnolia Virginiana, *L.* LAUREL MAGNOLIA, SWEET BAY.

The bark of the tree and root as well as the fruit of all the above species have similar medicinal properties. The root-bark is undoubtedly the most efficient. Magnolia is a gentle stimulant, aromatic tonic and diaphoretic.

Liriodendron Tulipifera, L. TULIP-TREE. YELLOW POPLAR, WHITEWOOD.

The bark of the root, trunk and branches are a stimulant tonic, with diaphoretic properties.

ORDER 3.

ANONACEÆ. (CUSTARD-APPLE FAMILY.)

Asimina triloba, L., Duval. PAPAW, CUSTARD-APPLE.

The fruit of this variety is sweet and edible when ripe, is yellow and pulpy when mature, and oblong in shape. The juice is anthelmintic.

Asimina parviflora, Duval. PAPAW.

The fruit is pear-shaped, few-seeded, and is not edible. The juice has properties analogous to the above. When eaten, is said to produce vomiting, followed by giddiness and severe pains in the head and stomach.

ORDER 4.

MENISPERMACEÆ. (MOONSEED FAMILY.)

Calycocarpum Lyoni, Parsh, Nutt. CUP-SEED.

Cebatha Carolina, L., Britton. CAROLINA MOONSEED.

Menispermum Canadense, L. CANADA MOONSEED. YELLOW PARILLA.

The roots of these plants are considerably employed as a substitute for sarsaparilla. They are doubtless tonic to a small degree in large doses, but are seldom used for such purposes in regular practice.

ORDER 5.

BERBERIDACEÆ. (BARBERRY FAMILY.)

Berberis Vulgaris, L. EUROPEAN BARBERRY.

Naturalized from Europe. The berries grow in loose bunches, are oblong and of a red color, and have a grateful, sour, astringent taste, and contain malic and citric acids. They are refrigerant, antiscorbutic and astringent.

Berberis Canadensis, Mill. AMERICAN BARBERRY.

This variety has properties analogous to the above and may easily be distinguished from it by the dark color of the twigs. The bitter, active principle, *berberine*, may be obtained from this variety as well as from the above.

Caulophyllum Thalictroides, L., Michx. BLUE COHOSH.

The roots of this plant have been collected and sold in the shops for years, and yet there is no positive evidence that they possess any medicinal properties beyond those claimed by the "eclectics." Is also said to have diaphoretic and various other remedial properties.

Diphylleia Cymosa, Michx. UMBRELLA-LEAF.

The roots are often sold in the shops for twin-leaf, but it is doubtful if they possess similar properties.

Jeffersonia diphylla, L., Pers. TWIN-LEAF.

The rhizome, with the young roots attached, is the part used, and is of a brownish yellow color, with a bitter, acrid taste, which is found in its cortical part, the inner portion being nearly tasteless. Has been found to contain albumen, gum, tannic acid, starch, saponin, and a fatty resin, sugar, lignin, and a peculiar acrid principle having acrid principles. Is said to be emetic in large doses, tonic and expectorant in smaller doses, and similar to seneca snake-root, for which it is sometimes substituted.

Podophyllum peltatum, L. MAY-APPLE. MANDRAKE.

The root is a slow but certain and active cathartic.

ORDER 6.

NYMPHÆACEÆ. (WATER LILY FAMILY.)

Cabomba Caroliniana, A., Gray. CAROLINA WATER-SHIELD.

Brasenia purpurea, Michx., Casp. WATER-SHIELD OR TARGET.

Both of the above plants have analogous properties and the leaves are mucilagenous, pectoral, and astringent.

Nymphœa advena, Soland. LARGE YELLOW POND LILY.

The roots are astringent, emolient, discutient, demulcent.

Nymphœa sagittæfolia, Walt. ARROW-LEAVED POND LILY.

Doubtless has similar properties to the above.

Castalia odorata, Dryland., Woodv. & Wood. WHITE WATER LILY, SCENTED POND LILY.

The root is astringent, vulnerary, and discutient. The leaves are vulnerary.

Nymphœa reniformis ? Walt. WATER LILY.

Is supposed by some to have similar properties to the above variety.

Nelumbium luteum Willd., Pers. AMERICAN LOTUS.

The tubers and seeds are farinaceous and edible, refrigerant, laxative, diuretic, and emolient.

ORDER 7.

SARRACENIACEÆ. (PITCHER PLANT FAMILY.)

Sarracenia purpurea, L. PITCHER PLANT, SIDE-SADDLE FLOWER.

The plant is bitter, astringent, tonic, stimulant, and diuretic.

Sarracenia flava, L. TRUMPET-LEAF.

The plant is laxative, stimulant, tonic, diuretic and astringent. The roots have analogous properties.

Sarracenia rubra, Walt. RED-FLOWERED TRUMPET-LEAF.

Properties similar to the above.

Sarracenia variolaris, Michx SPOTTED TRUMPET-LEAF, SMALL-POX PLANT.

This plant, at one time, attained some notoriety as a cure for small-pox, but has long since lost that reputation.

ORDER 8.

PAPAVERACEÆ. (POPPY FAMILY.)

Papaver somniferum, L. OPIUM OR GARDEN POPPY.

This plant is often cultivated for ornament, and may be found occasionally in waste grounds and on ballast. The flowers, leaves, and capsules, though analogous to opium in medicinal properties, are extremely feeble.

Papaver dubium, L. LONG SMOOTH-FRUITED POPPY.

Properties analogous to the above and often substituted for it.

Argemone Mexicana, L. MEXICAN AND PRICKLY POPPY.

It is claimed that this plant is emetic, purgative and narcotic. The seeds yield a valuable painter's oil used for drying purposes.

Sanguinaria Canadensis, L. BLOOD-ROOT, PUCCOON.

The root is an acrid emetic, with stimulant-narcotic powers. Small doses excite the stomach and accelerate the circulation; large doses produce nausea and depression of the pulse, accompanied by active vomiting. It is expectorant and emmenagogue. The effects of an overdose are violent emesis, a burning sensation in the stomach, tormenting thirst, faintness, vertigo, dimness of vision and alarming prostration. Death has resulted from an overdose of the tincture. When snuffed up the nose it produces much irritation and sneezing. Upon fungus surfaces it acts as an escharotic.

Chelidonium majus, L. CELANDINE.

The herb is an acrid purgative, with diuretic, expectorant and diaphoretic properties. An overdose produces unpleasant effects, and is doubtless poisonous.

Bicuculla Cucullaria, L., Millsp. DUTCHMAN'S BREECHES. COLIC WEED.

The root has diuretic, alterative, diaphoretic, and anti-syphilitic properties.

Bicuculla Canadensis, Goldie., Millsp. SQUIRREL CORN.

The root is anti-syphilitic, alterative and diuretic.

Bicuculla eximia, Ker., Millsp. TURKEY CORN. BLEEDING-HEART (DICENTRA).

The root is tonic, diuretic, alterative and anti-syphilitic.

All of the above are collected in this State and sold in the shops as turkey corn or pea, and they have somewhat analogous properties.

Adlumia fungosa, Ait., Greene. CLIMBING FUMITORY.

Capnoides sempervirens, L., Borck. PINK CORYDALIS.

Capnoides flavulum, Raf., Kuntze. PALE CORYDALIS.

Capnoides micranthum, Engelm., Britton. SMALL-FLOWERED CORYDALIS.

All of the above varieties supposed to have medicinal properties.

Fumaria officinalis, L. FUMITORY, HEDGE FUMITORY.

This plant is found is waste places and on ballast, and occasionally about the towns and villages, and locally in the interior of this State. The leaves are the officinal part, and have a bitter, saline taste; they are inodorous and very succulent, yielding by expression a juice which has the sensible, medicinal properties of the plant. Fumitory is considered a gentle tonic and alterative, and in large doses laxative and diuretic.

ORDER 9.

CRUCIFERÆ. (MUSTARD FAMILY.)

Lepidium campestre, L., R. Br. FIELD OR COW CRESS.

The plant is used as a salad. The seeds are acrid and astringent.

Lepidium Virginicum, L. WILD PEPPER-GRASS.

The leaves are pungent, diuretic, alterative and antiscorbutic.

Alliaria Alliaria, L., Britton. HEDGE-GARLIC. GARLIC MUSTARD.

The herb and seeds are esteemed diuretic, diaphoretic and expectorant.

Sisymbrium officinale, L., Scop. HEDGE MUSTARD.

This herb is said to be diuretic and expectorant.

Sinapis alba, L. WHITE MUSTARD.

Brassica nigra, L., Koch. BLACK MUSTARD.

If swallowed whole, mustard seed operate as a laxative. The white seed are preferred for such purposes.

Brassica campestris, L. TURNIP. WILD NAVEW.

Brassica Napus, L. RAPE.

The above varieties are sometimes found in waste places or cultivated grounds. The seeds yield rape oil.

Roripa palustris, L., Bess. MARSH WATER-CRESS.

Roripa Nasturtium, L., Rusby. WATER-CRESS.

The fresh herb has a bitterish, pungent taste, and a quick, penetrating odor when rubbed, both of which it loses when dried. It bears some resemblance to scurvy grass in medicinal properties, though in a milder form, and for this reason is preferred for table use.

Roripa Armoracea, L., Hitchcock. HORSE-RADISH.

The root is highly stimulant, and excites the stomach, promotes the secretions, especially that of urine, when swallowed. Externally it is rubefacient, the chief use of which it is put is as a condiment to promote the appetite and invigorate digestion.

Cardamine hirsuta, L. HAIRY BITTER-CRESS.

Cardamine parviflora, L. SMALL-FLOWERED BITTER-CRESS.
Cardamine flexuosa, Witt. WOOD WINTER-CRESS.
Cardamine Clematis, Shuttlw. MOUNTAIN WINTER-CRESS.
Cardamine bulbosa, Schrel., B. S. P. BULBOUS WINTER-CRESS.
Cardamine rotundifolia, Michx. AMERICAN WATER-CRESS.

The leaves of all the above are bitterish, slightly pungent, and supposed to possess antiscorbutic properties. They are thought by some to be diuretic.

Barbarea Barbarea, L., MacM. YELLOW CRESS.
Barbarea præcox, J. E. Smith, R. Br. EARLY WINTER-CRESS.

These plants are antiscorbutic, pectoral and detergent. The seeds are acrid, and lithontryptic. Useful as a salad plant.

Dentaria lacinata, Muhl. PEPPER-ROOT.
Dentaria diphylla, Michx. TOOTHWORT.
Dentaria heterophylla, Nutt. SLENDER TOOTHWORT.

The roots of the above are used as mustard.

Lunaria rediviva, L. SATIN-POD, SATIN FLOWER.

The root is detersive. The leaves are diuretic, and the seed are acrid. This and the following variety have escaped from cultivation.

Lunaria annua, L. MONEY-FLOWER. HONESTY.

The plant and flowers are diuretic.

Bursa Bursa-pastoris, L., Britton. SHEPHERD'S PURSE.

The plant is bitter and pungent, with astringent properties. It is thought to be antiscorbutic.

Camelina sativa, L., Crantz. FALSE FLOX.

The leaves have vermifuge properties, and the seeds yield an oil. The whole plant is nutritious to cattle.

Draba verna, S. VERNAL WHITLOW-GRASS.
Draba Caroliniana, Walt. CAROLINA WHITLOW-GRASS.
Draba ramosissima, Desv. BRANCHING WHITLOW-GRASS.

The seeds of the above are pungent and detersive.

Arabis Virginiana, L., Trealease. VIRGINIA ROCK-CRESS.
Arabis lyrata, L. LYRE-LEAVED ROCK-CRESS.
Arabis Canadensis, L. SICKLE-POD ROCK-CRESS.
Arabis lævigata Muhl., Poir. SMOOTH-LEAVED ROCK-CRESS.

The root and leaves of the cresses are pungent, diuretic and anti-scorbutic. The leaves are often used as a salad by the country people.

Hesperis matronalis, L. DAME'S ROCKET OR VIOLENT.

This plant has escaped from cultivation in some sections. The plant is diuretic in strangury.

Koniga maritima, L. R. Br. SWEET ALYSSUM.

The whole plant may be used in infusion where a refreshing drink is desirable during prostration.

ORDER 10.

RESEDACEÆ. (MIGNONETTE FAMILY.)

Reseda Luteola, L. Dyer's Rocket. YELLOW-WEED.

Reseda lutea, L. YELLOW CUT-LEAVED MIGNONETTE.

Both of these plants have escaped, sparingly, from cultivation along the sea-coast. They yield a yellow coloring matter used for dyeing purposes, and the whole plant has been employed in medicine as a diaphoretic and diuretic.

ORDER 11.

VIOLACEÆ. (VIOLET FAMILY.)

Viola pedata, L. BIRD'S-FOOT VIOLET.

The herb is mucilagenous, pectoral, emetic and laxative.

Viola Canadensis, L. CANADA VIOLET.

Viola blanda, Willd. SWEET WHITE VIOLET.

The leaves and roots of these are emetic and alterative.

Viola obliqua, Hill. MEADOW OR HOODED VIOLET.

The leaves are laxative, alterative, emetic and mucilagenous.

Viola rostrata, Pursh. LONG-SPURRED VIOLET.

This plant is pectoral and emetic.

Viola Labradorica, Schrank. AMERICAN DOG VIOLET.

The leaves are emetic, cathartic and vulnerary.

Viola palmata, L. EARLY BLUE VIOLET.

Viola villosa Willd. SOUTHERN WOOD VIOLET.

Viola rotundifolia, Michx. ROUND-LEAVED VIOLET.

Viola primulæfolia, L. PRIMROSE-LEAVED VIOLET.

Viola lanceolata, L. LANCE-LEAVED VIOLET.

Viola hastata, Michx. HALBERD-LEAVED VIOLET.

Viola scabriuscæla, T. & G. Schweim. SMOOTH YELLOW VIOLET.

Viola striata, Ait. PALE OR STRIPED VIOLET.

The roots of the above varieties have analagous properties, and have a bitter, nauseous, slightly acrid taste, and act as a cathartic and emetic.

Viola tricolor, L. PANSY.

Has been used as poultice.

ORDER 12.

CISTACEÆ. (ROCK-ROSE FAMILY.)

Helianthemum Canadense, L., Michx. FROST-WORT.
Helianthemum corymbosum, Michx. PAIL-BARREN FROST-WEED.
Helianthemum Majus, L., B. S. P. HOARY FROST-WEED.

These herbs have an astringent, slightly aromatic, bitterish taste, with tonic and astringent properties.

Lechea minor, L. THYME-LEAVED PIN-WEED.
Lechea racemulosa, Michx. OBLONG-FRUITED PIN-WEED.
Lechea villosa, Ell. LARGE PIN-WEED.
Lechea maritima, Leggett. BEACH PIN-WOOD.
Lechea Leggettii, Britt. & Holl. LEGGETT'S PIN-WEED.

These plants are tonic, febrifuge and anti-periodic.

ORDER 13.

HYPERICACÆE. (ST. JOHN'S-WORT FAMILY.)

Ascyrum stans, Michx. ST. PETERS-WORT.
Ascyrum hypericoides, L. ST. ANDREW'S CROSS.

These plants have astringent properties and the seeds are pungent.

Hypericum prolificum, L. SHRUBBY ST. JOHN'S-WORT.
Hypericum densiflorum, Parsh. BUSHY ST. JOHN'S-WORT.
Hypericum galioides, Cam. BED-STRAW ST. JOHN'S-WORT.
Hypericum adpressum, Bart. CREEPING ST. JOHN'S-WORT.
Hypericum perforatum, L. COMMON ST. JOHN'S-WORT.
Hypericum maculatum, Walt. SPOTTED ST. JOHN'S-WORT.
Hypericum graveolens, Buckley. MOUNTAIN ST. JOHN'S WORT.
Hypericum mutilum, L. DWARF ST. JOHN'S-WORT.
Hypericum Canadense, L. CANADA ST. JOHN'S-WORT.

These plants are collected and sold in the shops for one and the same thing, but they do not all possess similar and medicinal qualities. The *H. perforatum* has aromatic, astringent, nervine, and resolvent properties. The *H. prolificum* has diuretic and antiscorbutic qualities. All of the buds are vulnerary, and with this exception it is doubtful if the other varieties have any medicinal qualities worthy of mention.

Sarothra gentianoides, L. ORANGE-GRASS, NIT-WEED.

The herb is vulnerary.

Triadenum Virginicum, L., Rof. MARSH ST. JOHN'S-WORT.

Triadenum petiolatum, Walt., Britton. LARGE MARSH ST. JOHN'S-WORT.

These two varieties have similar properties to the *Hypericum perforatum*.

ORDER 14.

DROSERACEÆ. (SUNDEW FAMILY.)

Drosera rotundifolia, L. ROUND-LEAVED SUNDEW OR DEW-PLANT.

Drosera intermedia, Hayne. SPATULATE-LEAVED SUNDEW OR DEW-PLANT.

Drosera filiformis, Raf. THREAD-LEAVED SUNDEW OR DEW PLANT.

These plants are acrid, detergent, rubifacient, pectoral, and aphrodisiac.

ORDER 15.

CARYOPHYLLACEÆ. (PINK FAMILY.)

Agrostemma Githago, L. CORN COCKLE.

The seeds of this common pest are acrid, depurative, and purgative. · The roots have astringent and vulnerary properties.

Silene stellata, L., Ait. STARRY CAMPION.

Silene ovata ? Parsh. WHITE CAMPION.

Silene Virginica, L. CATCHFLY, FIRE PINK.

Silene Caroliniana, Walt. WILD PINK.

Silene antirrhina, L. SLEEPY CATCHFLY.

These plants are not officinal, though they have viscid, cordial, nervine and vermifuge properties. Some authorities claim they are poisonous.

Saponaria officinalis, L. SOAP-WORT, BOUNCING BET.

This plant is tonic, diaphoretic, alterative, anti-syphilitic, saponaceous and exanthematous. The roots and leaves are inodorous and have, at first, a bitterish, slightly sweet taste, which is afterwards pungent and continues long, leaving a sense of numbness on the tongue. They impart to water the property of forming a lather, when agitated, similar to a solution of soap, from which fact the plant derives its name. All plants which contain saponin, like this one, are capable of producing poisonous effects, and should not be used unless prescribed by a reputable physician. It has been found by experiment that this plant, when injected into the cellular tissue of the lower animals, has the extraordinary power of producing paralysis of the muscles, local in its nature; sensibility and motility are both suspended and the paralysis is followed by rigidity. Reflex motion is destroyed, and no irritant applied to the extremity has the least power of provoking contraction. A plant possessing such peculiar properties might be used to advantage in therapeutics.

Alsine media, L. COMMON CHICK-WEED

Alsine pubera, Michx., Britton. GREAT CHICK-WEED.

These plants are refrigerant, demulcent, mucilagenous, discutient and alterative.

Cerastium viscosum, L. MOUSE-EAR CHICK-WEED.

Cerastium vulgatum, L. LARGE MOUSE-EAR CHICK-WEED.

Cerastium arvense, L. FIELD MOUSE-EAR CHICK-WEED.

The herb of these plants is refrigerant, nutritious, anti-scorbutic, and sometimes used as a salad.

Scleranthus annuus, L. GERMAN KNOT-GRASS.

Astringent, emollient and diuretic properties are ascribed to this variety.

ORDER 16.

PORTULACACEAL. (PARSLANE FAMILY.)

Portulaca oleracea, L. PARSLANE, PUSSLEY.

Portulaca pilosa, L. HAIRY PORTULACA.

These plants have antiseptic, diuretic, aperient, and vulnerary properties.

Talinum teretifolium, Parsh. FAME-FLOWER.

The leaves have mild astringent and aperient qualities.

ORDER 17.

MALVACEÆ. (MALLOW FAMILY.)

Malva sylvestris, L. HIGH MALLOW.

Malva rotundifolia, L. LOW MALLOW.

Malva Moschata, L. MUSK MALLOW.

These plants are mucilagenous, diuretic, and emollient. The roots and seeds are highly mucilagenous. The flowers are pectoral. The *M. rotundifolia* was formerly used as a culinary herb, but has lost favor for such uses.

Abutilon Abutilon, L., Rusby. INDIAN MALLOW.

The leaves are demulcent, mucilagenous and diurectic. Not officinal.

Hibiscus Trionum, L. VENICE MALLOW, BLADDER KETMIA.

Plant demulcent and mucilagenous.

Hibiscus militoris, Cav. HALBERD-LEAVED OR ROSE MALLOW.

Properties similar to the above variety, though milder.

Hibiscus Moscheutos, L. SWAMP ROSE MALLOW.

The seed are cordial, stomachic, nervine and pungent.

Sida spinosa, L. FALSE MALLOW, PRICKLY SIDA.
Sida Elliottii, T. & G. ELLIOTT'S SIDA.

The leaves of the above are diuretic, demulcent and vulnerary.

ORDER 18.

TILIACEÆ. (LINDEN FAMILY.)

Tilia Americana, L. LINDEN, BASS-WOOD.
Tilia pubescens, Ait. SOUTHERN BASS-WOOD, WHITE-WOOD.
Tilia heterophylla, Vent. WHITE BASS-WOOD, BEE-TREE.

The bark of these trees is emollient, mucilagenous and vulnerary. The flowers are cephalic, stimulant, and sedative. Locally these parts are used quite extensively by the mountain people and are said to be of especial advantage in diseases calling for such treatment as they afford.

ORDER 19.

THEACEÆ. (TEA FAMILY.)

Gordonia Lasianthus, L. LOBLOLLY BAY, TAN BAY.

The bark is astringent, and dyes red.

ORDER 20.

MELIACEÆ.

Melia Azedarach, L. PRIDE OF CHINA, CHINA-BERRY.

The bark of the root is cathartic and emetic, and in large doses is said to be narcotic. It is considered an efficient anthelmintic with similar properties to *Spigelia*.

ORDER 21.

LINACEÆ. (FLAX FAMILY.)

Linum usitatissimum, L. FLAX, LINSEED.

Flaxseed is demulcent and emollient, and the mucilage obtained by infusing half an ounce of the whole seed to a pint of water, boiling hot, is much used.

Linum Virginianum, L. WILD OR YELLOW FLAX.

Linum sulcatum, Riddell. GROOVED YELLOW FLAX.

Both of the above may be substituted for the first.

ORDER 22.

GERANIACEÆ. (GERANIUM FAMILY.)

Geranium maculatum, L. CRANE'S-BILL ALUM-ROOT.

Crane's-bill root is styptic, antiseptic and astringent.

Geranium Robertianum, L. HERB ROBERT, RED ROBIN.

This species grows wild in some sections and has largely escaped from cultivation in this State. The herb has a disagreeable, bitter, astringent taste.

Geranium Carolinianum, L. CAROLINA CRANE'S-BILL.

The herb of this variety has bitter, astringent, febrifuge and nephritic properties.

ORDER 23.

OXALIDACEÆ. (WOOD-SORREL FAMILY.)

Oxalis Acetosella, L. WHITE OR TRUE WOOD SORREL.

Oxalis violacea, L. VIOLET WOOD SORREL.

Oxalis corniculata, L. YELLOW PROCUMBENT SORREL.

Oxalis filipes, Small, n. sp. SLENDER YELLOW SORREL.

Oxalis stricta, L. UPRIGHT YELLOW SORREL.

Oxalis grandis, Small. GREAT YELLOW SORREL.

The fresh herb eaten raw is said to be useful in scurvy. All of these plants are refrigerant, acid, diuretic, irritant and antiscorbutic. They have an agreeable sour taste and owe their acidity to *binoxalate of potassium*, which is often separated and sold in the shops under the name of *salt of sorrel* and may be used for removing ink stains and iron mold from linen. This is considered poisonous, and children have been known to die from constantly eating the raw herb of these plants. Such practice should be condemned at all times, as it may terminate fatally.

ORDER 24.

BALSAMINACEÆ. (JEWEL-WEED FAMILY.)

Impatiens biflora, Walt. SPOTTED TOUCH-ME-NOT, JEWEL-WEED.

The leaves have an acrid, burning taste, and when taken internally act as an emetic, cathartic and diuretic, though thought to be dangerous, and, therefore, little used. The flowers yield a yellow coloring matter and may be used for dyeing.

Impatiens aurea, Muhl. PALE TOUCH-ME-NOT.

This variety has similar properties to the above.

ORDER 25.

RUTACEÆ. (RUE FAMILY.)

Xanthoxylum Americanum, Will. AMERICAN PRICKLY ASH, TOOTHACHE-TREE.

Xanthoxylum Clava-Herculis, L. SOUTHERN PRICKLY ASH, PEPPER-WOOD.

The bark of the above varieties is pungent, stimulant, alterative, tonic, sialagogue, sudorific and antispasmodic, producing, when swallowed, a sense of heat in the stomach, with more or less arterial excitement, with a tendency to diaphoresis. It resembles *mezereum* and guiac in its remedial action. The powdered bark has been employed as a topical irritant, and the bark when chewed is a popular local remedy for toothache. *Aralia spinosa*, or Angelica tree, is often confounded with the above, because they are both sometimes called *prickly ash*. However, the latter bark is smooth externally and has a different taste.

Ruta graveolens, L. GARDEN RUE.

The herb is stimulant, antispasmodic, and in moderate doses emmenagogue, and if taken very largely it acts as an acrid narcotic poison.

Ptelia trifoliata, L. HOP-TREE, WAFER-ASH, TREFOIL.

The bark is tonic, stimulant, alterative, anti-periodic, and anthelmintic. The leaves should not be confounded with those of *Rhus radicans*, or poison-oak, which they closely resemble. The fruit has been used as a substitute for hops, and seem to answer the same purposes for which hops are used.

ORDER 26.

ANACARDIACEÆ. (SUMAC FAMILY.)

Rhus copallina, L. DWARF, OR MOUNTAIN SUMAC.

The leaves and bark contain much tannin and are collected in large quantities in this State, and ground for tanning purposes.

Rhus hirta, L., Sudw. STAGHORN SUMAC.

Bark rich in tannin.

Rhus glabra, L. SMOOTH UPLAND, OR SCARLET SUMAC.

The bark and leaves are astringent, and used largely, especially the leaves, in tanning leather and in dyeing. Excrescences are produced under the leaves resembling galls in appearance and character, which contain large quantities of tannic and gallic acids. These have been used as a substitute for the imported galls, and are in every way superior to them. The berries have a sour, astringent, not unpleasant taste, and are often eaten by country people with impunity. The berries also yield a red coloring matter, often used by the country people.

Rhus aromatica, Ait. FRAGRANT SUMAC.

The medicinal qualities of this variety have not been definitely determined.

Rhus vernix, L. POISON SUMAC, POISON ELDER.

This variety is more poisonous than the following, and persons coming within its influence are more apt to suffer severely than from the effects of the other varieties. The whole body is at times swollen entensively, and the affected person is scarcely able to move for several days, but the complaint generally subsides without destroying life. While some people can handle this plant with impunity, yet, its active poisonous principle is so severe as to warrant us in advising all parties to handle it with great caution. A poultice of sweet milk and gun-powder is said to be an effective antidote to these poisonous shrubs.

Rhus toxicodendron ?, L. SOUTHERN POISON OAK, OR THREE-LEAVED IVY.

This is a shrub of the Southern States with crenately-lobed, very pubescent leaflets. Very poisonous. Several cases of poisoning by the internal use of the plant are recorded—one by the root; one by the berries. The leaves appear to be stimulant and narcotic, producing, when swallowed, irritation of the stomach and bowels.

Rhus radicans, L. POISON IVY.

Very poisonous, having properties identical to the above.

ORDER 27.

ACERACEÆ. (MAPLE FAMILY.)

Acer Negundo, L. ASH MAPLE.

The bark of this tree is reputed astringent and vulnerary, and yields a reddish coloring matter.

Acer rubrum, L. RED OR SWAMP MAPLE.
Acer spicatum, Lam. MOUNTAIN MAPLE.
Acer saccharum, Marsh. SUGAR MAPLE.

The bark of these is anthelmintic, tonic and ophthalmicum. The *A. saccharum* is the source of tree or maple sugar and syrup.

ORDER 28.

HIPPOCASTANACEÆ. (BUCKEYE FAMILY.)

Æsculus glabra, Willd. FETID BUCKEYE.
Æsculus octandra, Marsh. YELLOW OR SWEET BUCKEYE.
Æsculus Pavia, L. RED BUCKEYE.

The bark is tonic, narcotic and febrifuge. The seeds are narcotic, farinaceous and poisonous, especially those of *A. Pavia.* The timber of *A. glabra* is extensively used for artificial limbs and a variety of woodenware articles. Horses, hogs and cattle, are very fond of the seeds.

ORDER 29.

CELASTRACEÆ. (STAFF-TREE FAMILY.)

Euonymus Americanus, L. STRAWBERRY BUSH.
Euonymus atropurpureus, Jacq. WAHOO, BURNING BUSH.

The bark of the bush and root is spoken of as tonic, hydragogue, cathartic, diuretic and anti-periodic.

Celastrus scandens, L. FALSE BITTER-SWEET, WAX-WORK.

The bark of the root is said to possess emetic, diaphoretic, narcotic and stimulant properties.

ORDER 30.

RHAMNACEÆ. (BUCKTHORN FAMILY.)

Rhamnus Caroliana, Walt. CAROLINA BUCKTHORN.

The medicinal qualities of the bark and berries has not been definitely determined.

Ceanothus Americanus, L. NEW JERSEY TEA, RED-ROOT.

The root is astringent, besides having purgative virtues. It may be used for dyeing purposes. The leaves have been used as a substitute for tea.

ORDER 31.

VITACEÆ. (GRAPE FAMILY.)

Vitis æstivalis, Michx. SUMMER GRAPE.
Vitis Labrusca, L. NORTHERN FOX GRAPE.

Vitis rotundifolia, Michx. Southern Fox Grape.

Vitis bicolor, LeConte. Winter Grape.

The leaves of the above varieties are astringent and styptic. They are largely used for pickling purposes. The fruit is acid. antiscorbutic, nutritious and refrigerant.

Parthenocissus quinquefolia, L., Planch. Virginia Creeper, Am. Ivy.

The bark and twigs are alterative, tonic, astringent, expectorant and diuretic.

ORDER 32.

POLYGALACEÆ. (MILKWORT FAMILY.)

Polygala Nuttallii, T. & G. Nuttall's Milkweed, Ground Centaury.

This herb is tonic, alterative and diuretic.

Polygala paucifolio, Willd. Fringed Milkweed, Flavoring Wintergreen.

This herb is bitter, diaphoretic, expectorant and pectoral.

Polygala polygama, Walt. Racemed Milkweed.

The herb and root is bitter, tonic, stimulant and expectrant.

Polygala incarnata, L. Pink Milkweed.

Polygala Senega, L. Seneca Snake–root.

The roots of the above are a stimulating expectorant and diuretic, and in large doses emetic and cathartic.

ORDER 33.

DRIPACEÆ. (PLUM FAMILY.)

Prunus Pennsylvanica, L. f. Wild Red or Pigeon Cherry.

The bark is bitter, acrid, tonic and astringent.

Prunus Virginiana, L. Choke Cherry.

Prunus serotina, Ehr. Wild Black Cherry.

These two varieties have similar properties. The bark is bitter, tonic, sedative, stimulant, pectoral and poisonous, and is considered one of the most valuable of our indigenous remedies.

Prunus Caroliniana, Ait. Cherry Laurel.

The leaves are poisonous and give an almond flavor. Improperly called mock-orange.

Amygdalis Persica, L. Peach.

The leaves are said to be laxative, and they probably exert a sedative influence over the nervous system.

ORDER 34.

CAESALPINACEÆ. (SENNA FAMILY.)

Cercis Canadensis, L. RED-BUD, JUDAS-TREE.

The powder of this tree is anti-scorbutic, and the fruit is edible.

Cassia nictitans, L. SENSITIVE PEA.

The leaves are cathartic and vermifuge.

Cassia occidentalis, L. COFFEE SENNA.

The juice is exanthematous. The root is diuretic and deobstruent.

Cassia Chamæcrista, L. PARTRIDGE PEA, SENSITIVE PEA.

Cassia Marylandica, L. WILD OR AMERICAN SENNA.

These two varieties have similar properties. The leaves are a prompt, safe and very efficient purgative.

Gleditsia triacanthus, L. HONEY LOCUST.

The seed and leaves are used as forage. The sap has saccharine qualities.

Gymnocladus dioica, L., Koch. KENUCKY COFFEE-TREE.

The seed and pods are emetic and nervine. The leaves are cathartic.

ORDER 35.

PAPILIONACEÆ. (PEA FAMILY.)

Cladrastis lutea, Mich., Koch. AMERICAN YELLOW-WOOD.

The bark is cathartic. The wood yields a yellow dye.

Baptisia tinctoria, L., R. Br. WILD INDIGO.

Baptisia villosa, Walt., Nutt. HAIRY WILD INDIGO.

Baptisia alba, L., R. Br. WHITE WILD INDIGO.

Baptisia leucantha, T. & G. LARGE WHITE, WILD INDIGO.

All of the above varieties have analogous properties, and are collected as one and the same thing by dealers in this State, no distinction being made, even in the shops when offered for sale. The *indigos* are alterative, anti-septic, emetic, emmenagogue and discutient, acting in large doses as a violent emetic and cathartic, in smaller doses as a mild laxative.

Lupinus perennis, L. WILD LUPINE.

The seeds are bitter and nutritious.

Cytisus scoparius, L., Link. SCOTCH BROOM.

The tops of the branches and seeds are the parts used. They are diuretic, cathartic, and in large doses, emetic.

Medicago sativa, L. PURPLE MEDIC, LUCERNE.

The seeds dye yellow. Cultivated as a forage crop.

Medicago lupulina, L. BLACK OR HOP LUCERNE.

The whole plant has lenitive properties, and is a forage crop.

Melilotus alba, Desv. WHITE SWEET CLOVER.

Melilotus officinalis, L., Lam. YELLOW SWEET CLOVER.

These plants have little remedial power, and though once recommended in various diseases, are no longer used officinally. They are supposed to possess very mild expectorant, diuretic, emollient, aromatic and pectoral qualities.

Trifolium arvense, L. RABBIT-FOOT OR OLD-FIELD CLOVER.

The leaves are pectoral and anti-dysenteric.

Trifolium pratense, L. RED CLOVER.

Trifolium repens, L. WHITE CLOVER.

The flowers are detergent and depurative.

Cracca Virginiana, L. DEVIL'S SHOE-STRING, GOAT'S RUE.

Cracca spicata, Walt., Kuntze. LOOSELY-FLOWERED GOAT'S RUE.

Cracca hispidula, Michx., Kuntze. FEW-FLOWERED GOAT'S RUE.

All of the above varieties have similar properties, and the tops and roots are both said to be anti-syphilitic, vermifuge, tonic, stimulant and aperient.

Robinia Pseudacacia, L. LOCUST-TREE, FALSE ACACIA.

Robinia viscosa, Vent. CLAMMY LOCUST.

The bark of the root is the most active part, and is said to be tonic, and in large doses purgative and emetic. Several cases of poisoning in children, who have eaten of the root by mistake, have been recorded. In this respect the action is similar to belladonna. However, all the children recovered. One of them was laboring under intermittent fever at the time, and had no return of the paroxysms after eating the root. These facts render caution necessary in the use of the root, yet are well calculated to stimulate inquiry.

Stylosanthes biflora, L., B. S. P. PENCIL-FLOWER.

The exact virtues of this plant have not been determined.

Vicia sativa, L. COMMON VETCH OR TARE.

The seed are detergent and astringent.

Apios Apios, L., MacM. GROUND NUT.

The root is farinaceous and edible.

Lespedeza sessilifolia, Michx. BUSH CLOVER.

The leaves are alterative and diuretic.

ORDER 36.

ROSACEÆ. (ROSE FAMILY.)

Opulaster opulifolius, L., Kuntze. NINEBARK.
Spiræa salicifolia, L. AMERICAN MEADOW SWEET.
Spiræa tomentosa, L. HARDHACK, STEEPLE-BUSH.
Spiræa Virginiana, Britton. VIRGINIA SPIRÆA.

All parts of the above shrubs have analogous medicinal qualities, and they are tonic and astringent, and are said to be antispasmodic.

Porteranthus trifoliatus, L., BRITTON. INDIAN PHYSIC, BOWMAN'S-ROOT.

The bark of the root is a mild and efficient emetic, and, like most substances, belonging to the same class, will occasionally act on the bowels.

Rubus odoratus, L. ROSE OR PURPLE-FLOWERING RASPBERRY.

The leaves and flowers are diuretic.

Rubus striatgosus, Michx. WILD RED RASPBERRY.

The fruit is esculent and laxative. The leaves are astringent, purgative and anti-emetic.

Rubus occidentalis, L. BLACK RASPBERRY, THIMBLE-BERRY.

The fruit is laxative. The leaves are a mild astringent.

Rubus villosus, Ait. HIGH BUSH BLACKBERRY.
Rubus trivialis, Michx. LOW BUSH BLACKBERRY.
Rubus Canadensis, L. LOW-RUNNING BLACKBERRY (DEWBERRY).

The roots of the above are tonic and strongly astringent. They have been a favorite local remedy in bowel affections, and from this popular favor have become officinal.

Fragaria Virginia, Duchesne. VIRGINIA OR SCARLET STRAWBERRY.
Fragacia vesca, L. EUROPEAN WOOD STRAWBERRY.

The fruit is edible, diuretic and refrigerant. The leaves are astringent and diuretic.

Potentilla Canadensis, L. CINQUEFOIL, FIVE-FINGER.

The whole plant is tonic and astringent.

Geum vernum, Raf., T. & G. SPRING AVENS.
Geum Virginianum, L. ROUGH AVENS.
Geum rivale, L. PURPLE OR WATER AVENS.

The roots of these plants have similar properties, are tonic and powerfully astringent.

Sanguisorba Canadensis, L. AMERICAN GREAT BURNET.

The whole herb is astringent and tonic in hemorrhages.

Agrimonia hirsuta, Muhl., Bicknell. AGRIMONY.

Agrimonia striata, Michx. WOODLAND AGRIMONY.

Agrimonia mollis, T. & G., Britton. SOFT AGRIMONY.

These plants are collected and sold to dealers as the same thing. They all have analogous properties. Both the leaves and the root have been used and are a mild astringent and corroborant.

ORDER 37.

CALYCANTHACEÆ. (STRAWBERRY-SHRUB FAMILY.)

Butneria florida, L., Kearney. ALLSPICE, STRAWBERRY-SHRUB.

Butnria fertilis, Walt., Kearney. ALLSPICE, SMOOTH STRAWBERRY-SHRUB.

The flowers are aromatic. The root is emetic. The bark is aromatic and stimulant.

ORDER 38.

LYTHRACEÆ. (LOOSE-STRIFE FAMILY.)

Decodon verticillatus, L., Ell. SWAMP LOOSE STRIFE OR WILLOW HERB.

The herb is mucilagenous, astringent, demulcent, and abortive to cattle.

ORDER 39.

ONAGRACEÆ. (EVENING PRIMROSE FAMILY.)

Isnardia palustris, L. MARSH PURSLANE.

This plant is pectoral in asthma and coughs.

Lugwigia alternifolia, L. RATTLE–BOX.

This herb is pectoral.

Chamænerion augustifolium, L., Scop. SPIKED WILLOW–HERB, FIRE–WEED.

Epilobium coloratum, Muhl. PURPLE–LEAVED WILLOW–HERB.

The leaves and roots of the two varieties above are, demulcent, tonic and astringent.

Onagra biennis, L , Scop. COMMON EVENING PRIMROSE.

Used as a lotion.

Kneiffia glauca, Michx., Spach. GLAUCOUS SUNDROPS.

This plant is emollient, detergent and exanthematous.

Circœa Lutetiana, L. ENCHANTER'S NIGHTSHADE.

This plant is resolvent and vulnerary.

ORDER 40.

CACTACEÆ. (CACTUS FAMILY.)

Opuntia Opuntia, L., Coult. Prickly Pear, Indian Fig.

This plant is refrigerant, and the juice colors red.

ORDER 41.

GROSSULARIACEÆ. (GOOSEBERRY FAMILY.)

Ribes Cynosbati, L. Wild Gooseberry.

Ribes rotundifolium, Michx. Eastern Wild Gooseberry.

Ribes prostratum, L'Her. Fetid Currant.

Ribes rubrum, L. Red Currant.

Ribes Uva-crispa, L. Garden Gooseberry.

The fruit of these varieties is acidulous, diuretic, refrigerant and febrifuge. The roots are diuretic, and the bark is said to be lithrontryptic. None of them are officinal.

ORDER 42.

CUCURBITACEÆ. (GOURD FAMILY.)

Melothria pendula, L. Creeping Cucumber.

The fruit is diuretic and vermifuge, and is often pickled.

Sicyos angulatus, L. Single-Seeded Cucumber.

The seeds are diuretic and purgative.

Cucurbita pepo, L. Pumpkin.

The seeds are the parts used medicinally, and have obtained considerable reputation in the treatment of tape-worm.

Citrullus vulgaris, Schrad. Watermelon.

The seeds are employed to a considerable extent as a domesiic remedy; esteemed diuretic. The juice of the melon is undoubtedly diuretic, and may be used as a pleasant and effective adjurant to other remedies in many cases of dropsy.

ORDER 43.

CRASSULACEÆ. (ORPINE FAMILY.)

Sedum roseum, L., Scop. Rose-root, Rosewort.

The root is astringent.

Penthorium sedioides, L. Virginia Stonecrop.

The whole herb is considered diuretic and astringent.

ORDER 44.

SAXIFRAGACEÆ. (SAXIFRAGE FAMILY.)

Tiarella cordifolia, L. COOLWORT, FALSE MITREWORT.

The herb is diuretic.

Heuchera Americana, L. ALUM-ROOT.

Heuchera pubescens, Parsh. DOWNY ALUM-ROOT.

The root is a powerful astringent.

Mitella diphylla, L. BISHOP'S CAP, MITREWORT.

The leaves of this plant are diuretic and astringent.

Parnassia Caroliniana, Michx. CAROLINA GRASS–OF–PARNASUS.

The seed are diuretic and aperient.

Hydrangea arborescens, L. SEVEN–BARKS, WILD HYDRANGEA.

The root is diuretic and lithrontryptic. The leaves are tonic, sialagogue, cathartic and diuretic.

Saxifraga Viginiensis, Michx. EARLY SAXIFRAGE.

Saxifraga Grayana, Britton. GRAY'S SAXIFRAGE.

Saxifraga micranthidifolia, Haw., B. S. P. LETTUCE.

The leaves and flowers of the above are diuretic, aperient and ornamental.

ORDER 45.

HAMAMELIDACEÆ. (WITCH HAZEL FAMILY.)

Fothergilla Carolina, L., Britton. FOTHERGILLA.

The bark and leaves are astringent and tonic.

Hamamelis Virginiana, L. WITCH HAZEL.

The bark is highly recommended in hemorrhage of the lungs and stomach. The seeds are farinaceous and edible like the hazel nut.

Liquidambar Styraciflua, L. SWEET-GUM, ALLIGATOR-TREE.

The juice is often employed as an addition to excitant ointments. The gum may be used for the same purposes as storax.

ORDER 46.

UMBELLIFERÆ. (CARROTT FAMILY.)

Daucus Carota, L. WILD CARROTT.

The seeds have an aromatic oder and a warm, pungent, bitterish taste.

Angelica Curtissii, Buckl. CURTIS' ANGELICA.
Angelica villosa, Walt., B. S. P. PUBESCENT ANGELICA.
Angelica atropupurea, L. PURPLE-STEMMED ANGELICA.
Ligusticum Canadense, L., Britton. NONDO ANGELICA.

The above varieties are collected in this State and sold as the same thing. The seed are carminative, stimulant, emmenagogue and aromatic. The principle use to which the root is put is flavoring tobacco, both smoking and chewing.

Conioselinum Chinense, L., B. S. P. HEMLOCK-PARSLEY.

This plant is anti-dysenteric, but should not be used by persons not thoroughly acquainted with it, because of its close resemblance to *Conium maculatum*, or Poison Hemlock, both of which grow in swamps.

Heracleum lanatum, Michx. COW-PARSNIP.

The roots, which are the parts used, have a disagreeable odor and very acid taste, producing redness and inflammation when applied to the skin. This plant is said to be poisonous. Masterwort (the local name) appears to be carminative and stimulant.

Pastniaca sativa, L. WILD PARSNIP.

The seed and tops are said to be diuretic.

Thaspium trifoliatum, L., Britton. PURPLE MEADOW PARSNIP.
Thaspium barbinode, Michx., Nutt. HAIRY-JOINTED PARSNIP.

The leaves of these plants are vulnerary, diuretic, anti-syphilitic and anti-venomous.

Eryngium aquaticum, L. RATTLESNAKE-MASTER, BUTTON SNAKE ROOT.

The root, which is the medicinal portion, has a bitter, pungent, aromatic taste, provoking, when chewed, a flow of saliva. It is diaphoretic, expectorant, in large doses emetic.

Sanicula Marylandica, L. BLACK SNAKEROOT, SANICLE.
Sanicula Canadensis, L. SHORT-STYLED SANICLE.

The roots of the above are nervine, anodyne, astringent and anti-periodic, and have been used locally in intermittent fevers.

Bupleurum rotundifolium, L. HARE'S EAR, THOROUGH-WORT.

The herb and seed are aromatic.

Fœniculum Fœniculum, L., Karst. FENNEL, DILL.

Formerly the roots were used for medicinal purposes, but at present only the seeds are employed. They are fragrant, and have a warm, sweet and agreeably aromatic taste, and yield their virtues to hot water, but more freely to alcohol. They are one of our most grateful aromatics, and are largely employed as a carminative and as a corrigent of other less pleasant medicines, such as senna and rhubarb.

Scandix Pecten—Veneris, L. SHEPHERDS' NEEDLE.

The whole plant is diuretic and vulnerary. The shoots are edible.

Washingtonia Claytoni, Michx , Britton. SWEET CICELY.

Washingtonia longistylis, Torr., Britton. SMOOTH SWEET CICELY.

The roots of these two plants have carminative, expectorant, demulcent, aromatic and stomatic properties.

Apium Petroselinum, L. COMMON OR GARDEN PARSLEY.

Parsley has escaped from cultivation in some sections of this State. It is claimed that the root is aperient, diuretic and nephritic, and the seed are said to be febrifuge. As a substitute for quinine in intermittents, the juice of the fresh herb has obtained some favor.

Apium graveolens, L. CELERY, SMALLAGE.

This plant has escaped from cultivation in some sections, especially near the sea-coast. The root and seeds are diuretic, the blanched tops a salad.

Zizia aurea, L., Koch. GOLDEN MEADOW-PARSNIP OR ALEXANDER.

The whole plant is mildly diuretic.

Carum Carui, L. CARAWAY.

The seeds are officinal, and have an agreeable aromatic smell, and a warm, sweetish, spicy taste. These properties depend on an essential oil, which they afford largely by distillation, though they yield their virtues readily to alcohol and more slowly to water. They are a pleasant stomachic and carminative and may be used in flatulent colic..

Ciucta maculata, L. POISON OR WATER HEMLOCK, SPOTTED COWBANE.

The whole plant, but more particularly the root, is acrid, narcotic, emetic, and violently poisonous. There are numerous instances on record where children have been fatally poisoned by eating the root, which closely resembles those of the parsnip in taste and smell. In cases of poisoning, vomiting should be induced as quickly as possible, and kept up until the stomach is entirely evacuated, after which the system should be supported. When this plant causes vomiting, as it often does, fatal effects are less apt to ensue.

Hydroctyle umbellata, L. MARSH PENNYWORT, WATER NAVELWORT.

The whole herb is said to be aromatic, emetic and alexipharmic.

Centella Asiatica, L., Urban. OVATE-LEAVED PENNYWORT.

This plant is said to be aromatic, narcotic and diuretic, in leprosy, though this claim has been both affirmed and denied by several celebrated authorities.

Sium cicutaefolium, Gmel. HEMLOCK WATER-PARSNIP.

This plant is only found in the middle districts of the State. The whole plant is anti-scorbutic, diuretic and poisonous.

Conium maculatum, L. POISON HEMLOCK.

The leaves and seed are narcotic, somewhat sedative to the circulation, and diminishes the action of the heart. When given so as to fully affect the system it produces more or less vertigo, dimness of vision, nausea, faintness, sensations of numbness, and general muscular debility, followed by paralysis and death. It should never be used unless by authority of some reputable physician.

ORDER 47.

ARALIACEÆ. (GINSENG FAMILY.)

Aralia nudicaulis, L. WILD SARSAPARILLA.

The root is a gentle stimulant and diaphoretic, having alterative properties similar to the true sarsaparilla.

Aralia racemosa, L. SPIKENARD.

The root is stimulant, balsamic, diaphoretic, alterative and pectoral.

Aralia hispida, Vent. DWARF ELDER, BRISTLY SARSAPARILLA

A decoction of the root has been given with success as a diuretic and is pleasanter to the taste and more acceptable to the stomach than most other remedies of the same class. The root is emetic, hydragogue, diuretic, alterative. The leaves are sudorific.

Aralia spinosa, L. ANGELICA-TREE, TOOTH-ACHE-TREE, PRICKLY ELDER.

This is a stimulant diuretic. The recent bark of the root is emetic and cathartic when given in infusion. The root-bark is a reputed antidote for the bite of the rattlesnake.

Panax quinquefolium, L. GINSENG.

The root is considered of little medicinal value in this country, and it is little more than a demulcent and aromatic. The Chinese consider it a panacea for "all the ills to which human flesh is heir." Beyond its commercial value it is a useless plant.

ORDER 48.

CORNACEÆ. (DOG-WOOD FAMILY.)

Cornus florida, L. DOGWOOD.

Cornus circinata, L'Her. ROUND-LEAVED DOGWOOD, GREEN OSIER.

Cornus Amorum, Mill. SILKY CORNEL, RED OSIER.

Cornus candidissimi, Marsh. PANICLED CORNEL.

Cornus alternifolia, L. f. ALTERNATE-LEAVED CORNEL.

With the exception of the first-named, all the other varieties are collected and sold as the same; but since they have similar properties this makes but little difference to the buyer. The back of the stems, branches and roots is used, and is astringent, tonic, febrifuge and anti-periodic. The flowers of *C. florida* are tonic and have the same bitter taste as the bark, and are sometimes used for the same purposes.

Nyssa sylvatica, Marsh. BLACK GUM, PEPPERIDGE.

Nyssa biflora, Walt. SOUTHERN OR WATER TUPELO.

Nyssa aquatica, L. LARGE TUPELO.

The fruit of these trees is acrid.

ORDER 49.

CAPRIFOLIACEÆ. (HONEYSUCKLE FAMILY.)

Triosteum perfoliatum, L. FEVERWORT.

Triosteum angustifolium, L. FEVERROOT.

The bark of the root is the part used, and it has a sickening odor, and a bitter, nauseus taste. It is cathartic, and in large doses emetic, possibly diuretic.

Symphoricarpus vulgaris, Mx. INDIAN CURRANT.

The root is astringent and tonic.

Symphoricarpus racemosus, Mx. SNOWBERRY.

The root is alterative and tonic, anti-syphilitic.

Lonicera sempervirens, Ait. HONEYSUCKLE.

The expressed juice of the plant will be found beneficial for the sting of bees, if rubbed directly on the injured spot. The fruit is said to be cathartic and emetic.

Diervilla trifida, Moluch. BUSH HONEYSUCKLE.

The whole plant, including root, branches and leaves, is said to be diuretic and astringent.

Sambucus Canadensis, L. ELDER.

The flowers are gently excitant and sudorific, but are seldom used, except externally as a discutient, in the form of poultice, fomentation or ointment. The berries are aperient and diaphoretic. The inner bark of the branches is a hydragogue cathartic and in large doses an emetic. The leaves contain active properties and the young leaf-buds are a violent and unsafe purgative. The juice of the root enjoys considerable repute as a hydragogue cathartic in dropsy.

Sambucus pubens, Mx. RED-BERRIED ELDER.

The bark is an emetic and hydragogue cathartic.

Viburnum dentatum, L. ARROW-WOOD, MEALY-TREE.

The bark is diuretic and detergent.

Viburnum Lentago, L. NANNY-BUSH.

The bark is anti-periodic.

Viburnum obovatum, Walt. PARAGUAY TEA?

The leaves are astringent, tonic and bitter.

Viburnum lantanoides, Michx. HOBBLE-BUSH.

The bark is anti-periodic and diuretic.

Viburnum acerifolium, L. DOCKMACKIE, MAPLE-LEAVED ARROW-WOOD.

It is said to be used externally to tumors.

Viburnum prunifolium, L. BLACK HAW.

The leaves are often used as a substitute for tea. The bark of the tree is tonic, astringent, diuretic, alterative and ophthalmicum. The root bark is said to be nervine, anti-spasmodic, astringent and tonic. The fluid extract is officinal, and is the best mode of administration.

ORDER 50.

RUBICACEÆ. (MADDERWORT FAMILY.)

Galium trifidum, L. SMALL CLEAVERS.

The whole herb is nervine, diuretic, expectorant and diaphoretic.

Galium circæzans, Michx. WILD LICORICE.

The whole herb is demulcent and diuretic. The other Galiums found in the State have similar properties.

Cephalanthus occidentalis, L. BUTTON–BUSH.

The bark is tonic, laxative, aperient, febrifuge and diuretic.

Mitchella repens, L. PARTRIDGE BERRY.

This small, evergreen plant, which grows about the roots of trees and has deep, red berries, which last through the winter, should not be confounded with *Gaultheria procumbens*, in consequence of its common name. It appears to be tonic, diuretic and astringent, resembling the *pipsissewa* in these respects.

ORDER 51.

VALERIANACEÆ. (VALERIAN FAMILY.)

Valeriana pauciflora, Mx. AMERICAN WILD VALERIAN.

The root is aromatic, stimulant, tonic, anodyne, nervine and anti-spasmodic. It is claimed for this variety that it may be substituted for the officinal drug, but in the absence of any responsible data on the subject it is thought advisable not to recommend its use unless prescribed by a regular physician. The virtues of the plant, if it has any, resides in the volatile oil.

ORDER 52.

COMPOSITAÆ. (COMPOSITE FAMILY.)

Vernonia angustifolia, Michx. IRON-WEED.

Vernonia fasciculata, Michx. IRONWEED.

The root of the above plants is bitter, tonic, alterative, depurgative, febrifuge.

Liatris odoratissima, Willd. DEER-TONGUE, VANILLA-LEAF.

The leaves are aromatic, tonic, stimulant, diaphoretic, and is largely used for flavoring tobacco and to preserve clothing, etc., from moths, but it is worthless for this purpose.

Liatris squarrosa, Willd. BLAZING STAR.

The root is tonic, diuretic, alterative, anti-syphilitic.

Liatris spicata, Willd. GAY FEATHER, BUTTON SNAKEROOT.

The root is diuretic, stimulant, diaphoretic and emmenagogue.

Liatris scariosa, Willd. RATTESNAKE'S MASTER.

Has properties analogous to the above.

Kuhnia eupatorioides, L. FALSE BONESET.

The whole herb is bitter, tonic and diaphoretic.

Eupatorium purpureum, L. QUEEN-OF-THE-MEADOW.

The root is diuretic, stimulant, tonic and astringent. The herb is diuretic and tonic.

Eupatorium hyssopifolium, L. JUSTICE WEED.

The whole plant is anti-venomous and may be used as a remedy from the bites of reptiles and insects, by being bruised and applied to the wound.

Eupatorium ageratoides, L. WHITE SANICLE.

The root is aromatic, tonic, diaphoretic and diuretic.

Eupatorium aromaticum, L. WHITE SNAKEROOT.

The root is diaphoretic, anti-spasmodic, expectorant, aromatic and diuretic.

Eupatorium rotundifolium, L. WILD HOREHOUND.

Eupatorium teucrifolium, Willd. WOOD BONESET.

Eupatorium perfoliatum, L. BONESET, THOROUGHWORT.

All of these plants have analogous properties, and are tonic, diaphoretic, emetic and aperient in large doses, and were at one time employed as an anti-periodic, but have lost this favor. They have been successfully employed as a tonic and diaphoretic in remittent and typhoid fevers.

Eupatorium collestinum? L. MIST FLOWER.

This herb is diaphoretic, expectorant and anti-spasmodic.

Aster puniceus, L. COCASH, RED-STALKED ASTER.

The root is diaphoretic, anti-rheumatic, tonic, aromatic, nervine.

Aster cordifolius, L. HEART-LEAVED ASTER.

The root is aromatic, tonic, nervine and diaphoretic.

Aster Tradescanti, L. MICHAELMAS DAISY.

The herb is aromatic and diaphoretic.

Aster undulatus, L. SMALL FLEABONE?

The root is tonic, aromatic and acrid, in dysentery.

Erigeron Philadelphicum, L. PHILADELPHIA FLEABANE.

Erigeron strigosum, Muhl. SCABIOUS.

These two plants are often collected and sold as the same thing. The herb has a feeble aromatic odor and bitterish taste. It is diuretic without offending the stomach.

Erigeron Canadense, L. CANADA FLEABONE.

The whole herb is diuretic, tonic and astringent.

Solidago rigida, L. HARD-LEAVED GOLDEN-ROD.

The herb is astringent and styptic.

Solidago odora, Ait? SWEET-SCENTED GOLDENROD.

The leaves have a fragrant odor, and a warm aromatic, agreeable taste, and are moderately stimulant and carminative, and like similar substances, diaphoretic when given in warm infusion. The dried flowers and leaves are often used as a pleasant and wholesome substitute for common tea.

Inula Helenium, L. ELECAMPANE.

The root is tonic and gently stimulant, and is supposed to be diaphoretic, diuretic, expectorant and emmenagogue.

Baccharis halimifolia, L. GROUNDSEL TREE.

The bark is demulcent, pectoral and aromatic.

Pterocaulon pycnostachium, Ell. INDIAN BLACKROOT.

The root is alterative and narcotic.

Polymnia Canadensis, L. LEAF-CUP.

Polymnia Uvedalia, L. BEARSFOOT.

Silphium perfoliatum, L. INDIAN CUP PLANT.

The root is diaphoretic, stimulant, diuretic and pectoral. The gum is styptic and anti-spasmodic.

Parthenium integrifolium, L. PRAIRIE DOCK, CUTTING ALMOND.

The root is supposed to be aromatic, bitter, stimulant, diuretic, nephritic and lithrontryptic.

Ambrosia artemisiæfolia, L. AMERICAN ROMAN WORMWOOD.

Ambrosia trifida, L. TALL AMBROSIA.

Ambrosia elatior ? RAGWEED.

These plants are considered astringent, and somewhat exciting. They are not officinal and their use is not recommended.

Xanthium strumarium, L. CLOT OR COCKLE-BUR.

May be substituted for *Arctium Lappa*, *Burdock*, which see.

Echinacea purpurea, Moluch. PURPLE CONEFLOWER.

The root is anti-syphilitic and depurient.

Rudbeckia laciniata, L. THIMBLEWEED.

The herb is diuretic, tonic and balsamic.

Helianthus tuberosus. JERUSALEM ARTICHOKE.

Has escaped largely from cultivation in some localities. The bulbs are edible, nutritious and diuretic.

Helianthus annuus. GARDEN SUNFLOWER.

Helianthus giganteus, L. WILD SUNFLOWER.

Helianthus divaricatus, L. ROUGH SUNFLOWER.

The leaves and seeds of the above are diuretic, expectorant and pectoral. The *H. annuus* is cultivated in this and other countries, chiefly for the fixed oil contained in the seed, which when pure is nearly free from flavor, and is said to make an excellent salad dressing, and to be one of the best burning oils known. The increase in cultivation is very great, the yield being nearly 300 pounds of oil per acre. The stalk, when treated as is flax, yields a long, fine fibre, used for the adulteration of silk. This plant enjoys the reputation of protecting against marsh miasmata when planted around malarial localities.

Coreopsis trichosperma, Michx. TICKWEED SUNFLOWER.

Coreopsis tripteris, L. SMALL TICKWEED SUNFLOWER.

The leaves and flowers are alterative and expectorant.

Bidens bipinnati, L. SPANISH NEEDLES.

The whole plant is expectorant, pectoral, emmenagogue.

Bidens frondosa, L. BEGGAR'S TICK.

The herb is expectorant and emmenagogue and is said to be useful in croup.

Verbesina Virginica, L. CROWN BEARD.

The root is diuretic and depurient.

Helenium autumnale, L. SNEEZEWEED.

The herb is tonic, diaphoretic and febrifuge. The flowers and leaves are errhine, and if snuffed up in the form of powder will produce violent sneezing.

Maruta cotula, D. C. MAYWEED, DOG FENNEL.

The leaves and flowers are pungent and bitter and impart their virtues to water. The properties are essentially the same as those of *Anthemis nobilis*, the garden Chamomile, for which they may be substituted. The whole plant is said to be emmenagogue and to have the property of vesicating if bruised and applied to the surface. (Anthemis cotula, L.)

Achillea millefolium, L. YARROW.

Both the flowers and leaves have an agreeeble, feeble aromatic odor and a bitterish, astringent, pungent taste. The aromatic qualities are strongest in the flowers, and the astringency in the leaves. The active principles are extracted by water or alcohol.

Leucanthemum vulgare, Lam. OX-EYE DAISY.

The leaves and flowers are acrid.

Tauacetum vulgare, L. TANSY.

This plant adds to the medicinal properties of the aromatic bitters those of an irritant narcotic. The seeds are said to be effectual as a vermifuge. Several fatal cases of poisoning are on record against this plant and it should be used with extreme caution.

Artemisia abrotanum. SOUTHERNWOOD.

The tops are fragrant, bitter, tonic, anthelmintic and astringent.

Artemisia Absinthium. WORMWOOD.

This plant is bitter, tonic, aromatic, febrifuge, anthelmintic, antiseptic, hepatic and discutient, and was known to the ancients. It is capable of causing headache and other nervous disorders. The volatile oil is a violent narcotic poison.

Artemisia vulgaris. MUGWORT.

The herb formerly enjoyed some reputation as an emmenagogue and has been used in epilepsy.

Gnaphalium polycephalum, Michx. LIFE EVERLASTING.

This herb is sometimes used, in the form of tea, by the country people, in diseases of the chest and bowels, in hemorrhagic affections, and externally, as a fomentation, in bruises, languid tumors, and other local troubles; but it doubtless possesses little medicinal virtue.

Antennaria margaritacea, R., Br. EVERLASTING.

The flowers are anodyne, pectoral, astringent and vermifuge.

Antennaria plantaginifol·a, Hook. MOUSE-EAR.

The leaves and flowers are diuretic and pectoral.

Cacalia suaveolens, L. WILD CARAWAY.

Cacalia reniformis, Muhl. WILD CARAWAY.

Cacalia atriplicifolia, L. WILD CARAWAY.

Cacalia tuberosa, Nutt. INDIAN PLANTAIN.

These plants are all emollient, like the mallow, and may be substituted for it whenever convenient or desirable.

Senecio aureus, L. LIFE-ROOT.

The herb is diuretic, diaphoretic, emmenagogue, expectorant and febrifuge.

Senecio lobatus, Pers. BUTTERWEED.

The leaves of this common "pest" are said to have vulnerary, tonic and astringent properties.

Seneccio hieracifolius, L. FIREWEED.

This plant is emetic, tonic, astringent and alterative. It has a bitterish, slightly acrid, disagreeable taste.

Centaurea benedictus, D. C. BLESSED THISTLE.

The leaves may prove tonic, diaphoretic or emetic.

Centaurea calcitrapa, L. KKAPWEED.

The root has tonic, febrifuge, and bitter properties, and the seed are diaphoretic.

Cirsium arvensis. CANADA THISTLE.

The root is tonic, diuretic, hepatic and anti-bilious. The leaves are anti-phlogistic, and it is claimed the roots have this latter property.

Arctium Lappa. BURDOCK.

The root is aperient, diaphoretic and diuretic.

Krigia Virginica, Willd. DWARF DANDELION.

Has similar properties to the *Taraxacum Dens-leon's* and may be substituted for it.

Hieracium venosum, L. HAWKWEED, BLOODWORT.

The whole herb is tonic, mucilagenous and astringent. The juice is said to have the power of removing warts.

Prenanthes alba. LION'S FOOT.

Prenanthes serpentaria. VARIETY LION'S FOOT.

These plants are bitter and anti-venomous, and have been used effectively as a remedy for the bite of poisonous serpents and insects. A decoction has proven effectual in ten or more cases of the bite of the rattlesnake in this State.

Taraxacum Dens-leonis, Desf. DANDELION.

This plant is plentifully naturalized in all sections of the State. The root is tonic, diuretic and aperient, and exerts a specific action upon the liver.

Lactuca elongata, Muhl. WILD LETTUCE.

The leaves and juice are said to be narcotic, sedative, anodyne, diuretic, diaphoretic and hypnotic.

Mulgedium acuminatum, D. C. BLUE LETTUCE.

Mulgedium Floridauum, D. C. FALSE LETTUCE.

The leaves of these plants are said to be anti-venomous, and when bruised and applied to the wound, are said to cure the bite of reptiles and insects.

Sonchus oleraceus, L. SOW THISTLE.

The juice is bitter and diuretic.

ORDER 53.

LOBELIACEÆ. (LOBELIA FAMILY.)

Lobelia cardinalis, L. CARDINAL FLOWER.

The whole plant is anthelmintic, anti-spasmodic and nervine, but is seldom used.

Lobelia syphilitica, L. BLUE CARDINAL, OR LOBELIA.

The herb is emetic, cathartic and diuretic.

Lobelia spicata, Lam. PALE BLUE LOBELIA.

This plant is said to be diuretic.

Lobelia inflata, L. INDIAN TOBACCO FIELD LOBELIA.

The leaves or capsules of this plant, chewed for a short time, will cause giddiness, headache, tremors, ultimately nausea and vomiting. A full dose will produce speedy and severe vomiting, attended with continued and distressing nausea, copious sweating and great relaxation. A tonic dose will add to the severity of these symptoms and will cause burning pain in the fauces or œsophagus, failure of the voluntary motion, feeble pulse, fall of temperature, stupor, convulsions, and often death. Its poisonous effects are more apt to occur when it is not rejected by vomiting. It should never be used as an emetic.

ORDER 54.

ERICACEÆ. (HEATH FAMILY.)

Azalea nudiflora, L. WILD HONEYSUCKLE, PINKSTER-FLOWER.

Azalea viscosa, L. SWAMP HONEYSUCKLE, WHITE AZALEA.

The leaves, flowers and stems are astringent.

Rhododendron maximum, L. GREAT OR MOUNTAIN LAUREL, WILD ROSE BAY.

The leaves are narcotic, stimulant, astringent and anti-rheumatic.

Kalmia augustifolia, L. SHEEP LAUREL, WICKY.

Kalmia latifolia, L. AMERICAN LAUREL CALICO-BUSH, IVY.

The leaves of these varieties are narcotic, poisonous, alterative, anti-syphilitic, sedative, astringent, errhine. They are said to prove fatal to sheep and some other animals, but are eaten with impunity by deer, goats and partridges. It is claimed that death has been occasioned by eating the flesh of birds which have fed upon them during the winter.

Pieris nitida, Bartr., Beuth. & Hook. FETTER-BUSH, PIPE-STEM.

The leaves are acrid and poisonous.

Pieris Mariana, L., Beuth. & Hook. STAGGER-BUSH, WICKE.

The leaves, in the form of decoction, are used in local practice as a cure for itch and other ulcerative affections. Is applied as a wash and not taken internally.

Oxydendrum arboreum, L., D. C. SOURWOOD, SORREL-TREE.

The bark and leaves are acid, astringent, febrifuge and refrigerant. The leaves have a pleasant acid taste, and are used by hunters to allay thirst, and form in decoction a grateful refrigerant drink in fevers.

Epigæa repens, L. TRAILING ARBUTUS, GROUND LAUREL.

This herb has been freely used, and to some advantage, in diseases of the urinary organs, and of the pelvic viscera, particularly of irritated action, in cases where *uva ursi* and *buchu* are indicated. It may be prepared and given in the same manner as the above drugs.

Gaultheria procumbens, L. WINTERGREEN, CHECKERBERRY, PARTRIDGE-BERRY.

This plant has the usual stimulant operation of the aromatics, united with astringency.

ORDER 55.

VACCINIACEÆ. (HUCKLEBERRY FAMILY.)

Gaylussacia frondosa, L., T. & G. BLUE TANGLE, BLUE WHORTLEBERRY.

The fruit is esculent, saccharine, diuretic and antiscorbutic.

Gaylussacia resinosa, Ait., T. & G. BLACK OR HIGH-BUSH HUCKLEBERRY.

The bark is diuretic and astringent. The fruit is esculent, saccharine and diuretic.

Gaylussacia dumosa, Audr., T. & G. DWARF OR BUSH HUCKLEBERRY.

The bark is diuretic. The leaves are astringent. The fruit similar to the above.

Vaccinium corymbosum, L. HIGH-BUSH OR SWAMP BLUEBERRY.

Has properties identical to the above.

Vaccinium stramineum, L. DEERBERRY, SQUAW HUCKLEBERRY.

The root is diuretic. The fruit is esculent, antiscorbutic, diuretic and astringent.

Vaccinium arboreum, Marsh. FARKLEBERRY.

The bark and fruit is astringent.

Oxycoccus macrocarpus, Ait., Pers. AMERICAN CRANBERRY.

Oxycoccus erythrocarpus, Michx., Pers. SOUTHERN MOUNTAIN CRANBERRY.

These two have analogous properties. The leaves are diuretic. The fruit is acidulous, refrigerant, condiment and antiscorbutic.

ORDER 56.

CLETHRACEÆ. (WHITE ALDER FAMILY.)

Clethra alnifolia, L. WHITE ALDER, SWEET PEPPER-BUSH.

Clethra acuminata, Michx. MOUNTAIN SWEET PEPPER-BUSH.

The leaves and flowers of the above are diaphoretic and excitant.

ORDER 57.

PYROLACEÆ. (WINTERGREEN FAMILY.)

Pyrola rotundifolia, L. ROUND-LEAVED WINTERGREEN OR PYROLA.

The leaves are tonic, astringent, diuretic and anti-spasmodic.

Chimaphila maculata, L., Parsh. SPOTTED WINTERGREEN.

Chimaphila umbellata, L., Nutt. PIPSISSEWA.

These plants are diuretic, tonic and astringent.

ORDER 58.

MONOTROPACEÆ. (INDIAN PIPE FAMILY.)

Monotropa uniflora, L. FITROOT, INDIAN PIPE.

The root is tonic, sedative, nervine, anti-spasmodic.

Hypopitys Hypopitys, L., Small. PINESAP, FALSE BEECH-DROPS.

The root is bitter, emetic and diuretic.

ORDER 59.

DIAPENSIACEÆ. (DIAPENSIA FAMILY.)

Galax aphylla, L. BEETLE-WEED.

The root is astringent. The leaves are vulnerary.

ORDER 60.

ILICACEÆ. (HOLLY FAMILY.)

Ilex opaca, Ait. AMERICAN HOLLY.

The leaves are of a bitter, somewhat austere taste, and were once highly esteemed as a diaphoretic. The berries are red and bitterish, and are said to be purgative, emetic and diuretic.

Ilex Cassine, L. DAHOON HOLLY.

Ilex vomitoria, Ait. YAUPON, CASSENA, CAROLINA TEA.

Ilex glabra, L., A. Gray. INKBERRY, EVERGREEN WINTERBERRY.

Ilex decidua, Walt. MEADOW HOLLY.

Ilex monticola, A. Gray. LARGE-LEAVED HOLLY.

The above named varieties have similar properties. A decoction made from the toasted leaves was used by the Indians as a drink and medicine. It acts as an emetic, even in small doses.

Ilex verticillata, L., A. GRAY. BLACK ALDER, FEVER-BUSH.

The bark is considered tonic and astringent, and was once used as a substitute for Peruvian bark, with which, however, it has little, if any, analogy.

ORDER 61.

STYRACACEÆ. (STORAX FAMILY.)

Styrax Americana. SMOOTH STORAX, SPRING ORANGE.

The balsam is aromatic, expectorant, pectoral and vulnerary.

ORDER 62.

EBENACEÆ. (EBONY FAMILY.)

Diospyros Virginiana, L. PERSIMMON.

The bark is astringent and very bitter.

ORDER 63.

PRIMULACEÆ. (PRIMROSE FAMILY.)

Samolus floribundus, Kenth. WATER PIMPERNEL.

The leaves are vulnerary and purgative.

Lysimachia quadrifolia, L. CROSSWORT, LOOSESTRIFE.

The herb is astringent, stomatic, expectorant and anti-periodic.

Anagallis arvensis, L. RED PIMPEREL OR CHICKWEED.

This plant has been recommended as a local application to old and ill-conditioned ulcers, consumption, dropsy and epilepsy. The fluid extract in four drachm doses has proved fatal to dogs.

ORDER 64.

PLANTAGINACEÆ. (PLANTAIN FAMILY.)

Plantago major, L. LARGE PLANTAIN, MAYBREAD.

The whole plant is astringent, diuretic, anti-septic, anti-syphilitic.

Plantago cordata, Lam. HEART-LEAVED PLANTAIN.

The leaves are refrigerant, diuretic sub-styptic, astringent, anodyne and anti-emetic.

Plantago lanceolata, L. SNAKE PLANTAIN, RIBWORT.

The root and leaves are astringent, vulnerary and alterative.

Plantago Virginica, L. WHITE PLANTAIN.

The herb is vulnerary, diuretic, anti-venomous.

ORDER 65.

PLUMBAGINACEÆ. (LEADWORT FAMILY.)

Limonium Carolinianum, Walt., Britton. CANKER-ROOT, MARSH ROSEMARY.

The root is astringent.

ORDER 66.

LENTIBULACEÆ. (BUTTERWORT FAMILY.)

Pinguicula lutea, Walt. BUTTERWORT.
The flowers are purgative. vulnerary and detergent.

Pinguicula elatior, Michx.
Has similar properties to the above.

Utricularia inflata, Walt. BLADDERWORT.

Utricularia purpurea, Walt. PURPLE BLADDERWORT.

Utricularia striata, Le Conte.

Utricularia vulgaris, L. MARSH BLADDERWORT.

Utricularia subulata, L.

Utricularia cornuta, Michx.
The herbs of the above varieties are diuretic.

ORDER 67.

OROBANCHACEÆ. (BROOMRAPE FAMILY.)

Epiphegus Virginiana, Bart. CANCER-ROOT, BEECH-DROPS.
Orobanche Americana, L., Walt? SQUAW-ROOT.
Orobanche uniflora, L., Mitchell? BROOM-RAPE.
The roots of the three above varieties are nauseous, bitter, astringent, depurrative and vulnerary. They are not officinal and it is doubtful if they are beneficial in any disease.

ORDER 68.

BIGNONIACEÆ. (TRUMPET FLOWER FAMILY.)

Bignonia capreolata, L. CROSS-VINE.
The root is largely used as a substitute for sarsaparilla by patent medicine men.

Bignonia (Tecoma) radicans, L. TRUMPET FLOWER.
The root is vulnerary, sudorific and anti-venomous.

Martynia proboscidea, Glox. DOUBLE-CLAW.
The fruit is used for pickling.

Catalpa bignonioides, Walt. CATAWBA-TREE.
The pods are tonic and vermifuge. Relief from ordinary asthma has been found by smoking the pods the same as cubebs.

ORDER 69.

LOGANIACÆ. (LOGANIA FAMILY.)

Gelsemium sempervireus, L., Ait. f. YELLOW JESSAMINE.

The root is the part used and produces agreeable sensations of languor, followed by muscular relaxation. More largely taken it produces dizziness, dimness of vision, dilated pupil, general muscular debility, and complete prostration, reducing the force and frequency of the pulse, and the frequency of respiration. Numbers of cases are recorded where these symptoms have increased until death occurred.

Spigelia Marylandica, L. INDIAN OR CAROLINA PINK-ROOT.

The root is a powerful anthelmintic, and in ordinary doses produces little sensible effect on the system; more largely given it is cathartic; in over doses it excites the circulation, produces dimness of vision, vertigo, dilated pupils, spasms of the facial muscles, and general convulsions, followed by death in some instances, especially when taken by children.

Cynoctonum Matreola, L., Britton. MITREWORT.

The root is anthelmintic and reputed anti-venomous.

ORDER 70.

SCROPHULARIACEÆ. (FIGWORT FAMILY.)

Leptandra Virginica, Nutt. CULVER'S PHYSIC.

The recent root will act violently as a cathartic, and often as an emetic. It is much milder in the dried state.

Verbascum Thapsus, L. MULLEIN.

Verbascnm Blattaria, L. MOTH MULLEIN.

Both the leaves and flowers of the above have been employed as remedial agents, and they have a slight odor, and a mucilaginous, herbaceus, bitterish taste, and are demulcent and emollient, with anodyne properties.

Scrofularia nodosa, L. SCROFULA PLANT, FIGWORT.

The whole herb is considered tonic, diuretic, diaphoretic, discutient and anthelmintic.

Chelone glabra, L. BALMONY, SNAKE-HEAD.

The leaves are bitter, aperient, tonic, cathartic, anthelmintic and hepatic.

Linaria vulgaris, Miller. TOAD-FLAX.

The herb is cathartic and diuretic.

Gratiola Virginiana, L. VIRGINIA HEDGE-HYSSOP.

Gratiola aurea, Muhl. HEDGE-HYSSOP.

Gratiola officinalis, L. SMOOTH HEDGE-HYSSOP.

All of the above have drastic cathartic, emetic and diuretic properties.

Veronica officinals, L. SPEEDWELL, PAUL'S BETONY.

The herb is expectorant, tonic, alterative and diuretic, and was formerly employed in pectoral and nephitic complaints, hemorrhages, and diseases of the skin. It is not officinal.

Veronica peregrina, L. PURSLANE, SPEEDWELL.

The herb is depurient and has been used as a wash to scrofulous ulcers.

Veronica Beccabunga, BROOKLIME.

The herb is anti-scorbutic, emmenagogue, diuretic, exanthematous and febrifuge, but is little used at present.

ORDER 71.

VERBENACEÆ. (VERVAIN FAMILY.)

Verbena hastata, L. BLUE VERVAIN.

The whole herb is emetic, tonic, expectorant, sudorific and vulnerary.

Verbena officinalis, L. WHITE VERVAIN.

The herb is febrifuge, emetic, vulnerary and rubefacient.

Verbena urticifolia, L. NETTLE-LEAVED VERVAIN.

This plant has been used with *Quercus alba* in Rhus poison.

Callicarpa Americana, L. FRENCH MULBERRY.

The berries are astringent and acidulous.

ORDER 72.

LABIATAE. (MINT FAMILY.)

Ocimum basilicum, L. SWEET BASIL.

The whole plant has a peculiar, agreeable, aromatic odor which is improved by drying. The taste is aromatic, cooling and saline. Has the ordinary properties of the aromatic plants and is considerably used as a condiment.

Lavendula spica, L. LAVENDAR.

The whole plant is an aromatic stimulant and tonic. The products derived from its distillation are much used in perfumery and as an adjuvant to other medicines, which they render more acceptable to the palate and cordial to the stomach.

Teucrium Canadense, L. GERMANDER WOOD-SAGE.

This plant is stimulant, aromatic, tonic, bitter and anti-rheumatic.

Mentha piperita, L. PEPPERMINT.

The whole herb is a grateful aromatic stimulant, much used to allay nausea, to relieve spasmodic pains of the stomach and bowels, for expelling flatus, and to cover the taste or qualify the nauseating or griping effects of other medicines. The oil is stimulating and carminative.

Mentha viridis, L. SPEARMINT.

The virtues and applications of this variety are the same as the above, though it is said to be more agreeable to the taste and stomach.

Mentha rotundifolia, L. PATAGONIA-MINT.

The leaves are stomachtic, stimulant and carminative.

Mentha arvensis. WATER CALAMINT.

This plant is bitter, pungent, anti-rheumatic and anti-spasmodic.

Lycopus Virginicus, L. SWEET BUGLEWEED.

This is a mild narcotic and astringent.

Lycopus Europeous. BITTER BUGLEWEED.

This plant is often collected and sold in this State for the above. It has been used as a substitute for quinine.

Cunila Mariana, L. DITTANY.

The herb is a stimulant aromatic, analogous to the mints and pennyroyal. The oil is rubefacient, carminative and diaphoretic.

Hedeoma pulegioides, Pers. PENNYROYAL.

The whole herb is a gentle stimulant aromatic.

Collinsonia Canadensis, L. STONE-ROOT.

The whole plant has a strong, disagreeable odor, and a warm, pungent taste, and is considered tonic, astringent, diaphoretic and diuretic. The root, if given in substance, even in small doses, will irritate the stomach and produce vomiting.

Hyssopus officinalis, L. HYSSOP.

This is an aromatic stimulant.

Pycnanthemum incanum, Michx. WILD BASIL.

Pycnanthemum aristatum, Michx. WILD BASIL.

These plants are said to be diuretic, stimulant, anti-spasmodic, carminative and tonic.

Pycnanthemum pilosum, Nutt. THYME-LEAVED BASIL.
Pycnanthemum linifolium, Parsh. FLAX-LEAVED BASIL.
Pycnanthemum montanum, Michx. MOUNTAIN-MINT.

The plants are supposed to be diaphoretic, tonic and sedative. The oil is stimulant; not officinal.

Satureja hortensis, L. SAVORY.

This plant has an aromatic odor and taste.

Origanum vulgare, L. WILD MARJORAM.

The herb has a peculiar, agreeable, aromatic odor and a warm, pungent taste, is gently tonic and excitant.

Origanum Marjorana, L. SWEET MARJORAM.

This plant has similar virtues to the above, for which it may be substituted.

Thymus vulgaris, L. GARDEN THYME.

The herb is resolvent, carminative, tonic, emmenagogue and anti-spasmodic and may be used for the same purposes as either of the above.

Calamintha Nepeta, Link. FIELD CATMINT.

The whole herb is aromatic, carminative and stomachtic.

Melissa officinalis, L. LEMON BALM.

An infusion of the herb will be found an agreeable and excellent drink in febrile complaints, and when taken warm, has a tendency to promote the operation of diaphoretic medicines.

Salvia officinalis, L. GARDEN SAGE.
Salvia Sclarea. CLARRY.

These varieties have tonic, astringent and aromatic properties.

Salvia lyrata. WILD SAGE, CANCER-WEED.

The juice of the leaves is said to be used for removing warts and in some cancerous troubles.

Rosemarinus officinalis, L. ROSEMARY.

This is a gentle stimulant, and has been considered emmenagogue. It is scarcely used in this country, though it enjoys some reputation in Europe.

Monarda didyma, L. MOUNTAIN MINT, OSWEGO TEA.

The herb and oil are rubefacient, stimulant, carminative and aromatic.

Monarda fistulosa, L. WILD BERGAMOT.

The leaves are aromatic, bitter, nervine, stomachic.

Monarda punctata, L. HORSEMINT.

The herb is stimulant, carminative, sudorific, diuretic, emmenagogue and anti-emetic.

Blephilia hirsuta, Benth. OHIO HORSEMINT.

The herb is aromatic, carminative, tonic and stimulant.

Nepeta Cataria, L. CATNIP.

The whole herb acts on the system as a tonic and excitant, similar to the mints. It also enjoys the reputation of being anti-spasmodic and emmenagogue.

Nepeta Glechoma, Benth. GROUND IVY.

The whole herb is a gentle stimulant and tonic, with a peculiar direction to the lungs and kidneys. It once obtained some notoriety as a remedy in consumption, which, unfortunately it has not sustained.

Brunella vulgaris, L. HEAL-ALL, SELF-HEAL.

A decoction or infusion of the leaves and flowers has been used in hemorrhages and diarrhœa, and as a gargle in sore throat.

Scutellaria integrifolia, L. LARGE-FLOWERED SCULLCAP.

Scutellaria hyssopifolia. HYSSOP-LEAVED SCULLCAP.

These two plants are intensely bitter and might be found useful as a tonic.

Scutellaria lateriflora, L. BLUE SCULLCAP.

This plant is probably of no remedial value, for when taken internally it produces no very obvious effect on the system, though it has been esteemed useful as a nervine.

Lamium amphlexicaulis, L. DEAD NETTLE, HENBIT.

This plant is stimulant, laxative, sudorific, anti-rheumatic and cephalic. Should not be used in local practice except when prescribed by a physician.

Stachys palustris. HEDGE NETTLE, CLOWN-HEAL.

The herb is nauseous, expectorant, emmenagogue, anti-hysteric and vulnerary.

Leonorus Cardiaca, L. MOTHERWORT.

Marrubium vulgare, L. HOREHOUND.

The herb is tonic, in large doses laxative. It is chiefly employed in catarrh and other chronic affections of the lungs, when attended with cough or copious expectoration. It is much used in syrup and candy.

ORDER 73.

BORRAGINACEÆ. (BORAGE FAMILY.)

Echium vulgare, L. VIPER'S BUGLOSS.

The root is astringent and depurative.

Borrago officinalis, L BORAGE.

All parts of this plant abound in mucilage, and an infusion sweetened with honey or syrup is employed as a demulcent, refrigerant, and is gently diaphoretic.

Symphytum officinale, L. COMFREY.

The root is chiefly used as a demulcent, and may be advantageously employed for all the purposes to which marshmallow is used. It is a very common ingredient in domestic cough mixtures.

Onosmodium Carolinianum, D. C. FALSE GROMWELL.

Onosomdium Virginianum, D. C. JOB'S TEARS.

The root and seed of both the above have diuretic, tonic and lithontryptic properties.

Lithospermum arvense, L. STONE SEED.

The seed are diuretic and lithrontryptic. The plant yields a red dye.

Pulmonaria Virginica, L. LUNGWORT COWSLIP.

The plant is mucilagenous and demulcent.

Cynoglossum officinale, L. HOUND'S TONGUE.

Cynoglossum Morisoni, D. C. VIRGINIA MOUSE-EAR.

Cynoglossum Virginicum, L. WILD COMFREY.

The roots of these plants are all collected and sold as the same thing by dealers in this State. The *Cynoglossum officinale* has been used as a demulcent and sedative in coughs, etc., and externally in burns, ulcers, scrofulous tumors and goitre. There is a wide difference of opinion as to the powers of all the above. Some consider them almost inert, while others look upon them as a dangerous poison.

ORDER 74.

HYDROPHYLLACEÆ. (WATERLEAF FAMILY.)

Hydrophyllum Virginicum, L. BURR FLOWER.

The herb is astringent and diuretic.

ORDER 75.

POLEMONIACEÆ. (PHLOXWORT FAMILY.)

Polemonium reptans, L. AMERICAN-GREEK VALERIAN.

The root is alterative, diaphoretic, pectoral, diuretic, expectorant and anti-venomous.

ORDER 76.

CONVOLONLACEÆ. (BINDWEED FAMILY.)

Pharbitis—varieties. MORNING-GLORY.

The roots are cathartic.

Ipomca pandurata, Meyer. WILD POTATO.

The root is cathartic, diuretic, herpatic, anti-venomous and lithontryptic.

Convolvulus arvensis, L. BIND-WEED.

The root is purgative and diuretic.

Calystegia Sepium, Br. GERMAN SCAMMONY.

The gum and resin is a powerful cathartic, often griping.

ORDER 77.

SOLANACEÆ. (NIGHTSHADE FAMILY.)

Solanum nigrum, L. GARDEN NIGHTSHADE.

The flowers are diaphoretic, narcotic and poisonous; in oil they are anodyne and discutient.

Solanum Carolinense, L. HORSE NETTLE.

The herb is narcotic and anodyne.

Solanum Pseudo-Capsicum, L. JERUSALEM CHERRY.

The herb is anodyne. The fruit is narcotic. Several cases of fatal poisoning are on record from children eating the fruit.

Physalis viscosa, L. GROUND CHERRY.

Physalis pubeescens, L. LARGE GROUND CHERRY.

The fruit is diuretic and sedative.

Datura Stramonium, L. JAMESTOWN-WEED, THORN APPLE.

Though a poisonous and intoxicating herb it has been used with reputed success in nervous diseases. Dangerous and even fatal cases are on record from its incautious or improper use.

ORDER 78.

GENTIANACEÆ. (GENTIAN FAMILY.)

Sabbatia angularis, L., Parsh. AMERICAN RED CENTUARY.

The herb and flowers have the tonic properties of the simple bitters, and has long been employed as a prophylactic and remedy in our autumnal remittent and intermittent fevers.

Gentiana quinquefolia, L. STIFF GENTIAN, AGUE-WEED.

The plant and root are bitter and tonic.

Gentiana Saponaria, L. SOAPWORT GENTIAN.

The root is bitter, tonic, diaphoretic and anti-bilious.

Gentiana villosa, L. STRIPED GENTIAN, SAMPSON SNAKE-ROOT.

The root is bitter, tonic, anthelmintic, astringent, anti-bilious.

Gentiana crinita, Froel. FRINGED GENTIAN.

Gentiana Elliottii, Chapm. ELLIOTT'S GENTIAN.

These two varieties have similar properties to the officinal drug, G—*lutea* and the roots are tonic, bitter, emetic, anthelmintic, anti-bilious and stomachic.

Frasera Carolinensis, Walt. AMERICAN COLUMBO.

The root is tonic, bitter, febrifuge and antiseptic.

ORDER 79.

APOCYNACEÆ. (DOGBANE FAMILY.)

Apocynum cannabinum, L. BLACK INDIAN HEMP.

The root is emetic, cathartic, diuretic, sudorific and sternatatory, and like other emetic substances, promotes diaphoresis and expectoration. Produces much nausea, diminishes the frequency of the pulse and induces drowsiness. This plant should not be confounded with *Cannabis Indica* which has the same local name, and is very poisonous in overdoses.

Apocynum androsaemifolium, L. BITTER-ROOT.

The root is emetic, cathartic, diuretic, sudorific, expectorant and authelmintic.

Vinca major. LARGE PERIWINKLE.

The herb is tonic, astringent and discutient.

Vinca minor. SMALL PERIWINKLE.

The herb is tonic, bitter, astringent.

ORDER 80.

ASCLEPIADACEÆ. (MILKWEED FAMILY.)

Asclepias Syriaca, L. COMMON MILKWEED.

Asclepias tomentosa, Ell. PINEWOOD'S MILKWEED.

The roots of the above varieties are tonic, diuretic, alterative, emmenagogue, purgative and emetic.

Asclepias incarnata, L. WHITE INDIAN HEMP.

The root is alterative, authelmintic, emetic and cathartic.

Asclepias verticillata, L. WHORLED MILKWEED.

Used for snake bites and the sting of venomous insects.

Asclepias tuberosa, L. PLEURISY–ROOT, BUTTERFLY.

The root is diaphoretic and expectorant without being stimulant. It is cathartic in large doses. When freely given it will produce copious diaphoresis and diminish the volume and activity of the pulse. It is also said to be slightly sedative and astringent.

Acerates viridiflora, Ell. GREEN MILKWEED.

The herb is carminative, tonic, diuretic and spasmodic.

Gonobolus hirsutus, Michx. NEGRO–VINE.

The root is drastic, cathartic. The juice is narcotic.

Gonobolus macrophyllus, Michx. ANGLE POD.

The root is cathartic. The juice is poisonous.

ORDER 81.

OLEACEÆ. (OLIVE FAMILY.)

Olea Americana, L. AMERICAN OLIVE.

Supposed to have medicinal properties which have not been fully determined.

Fraxinus Americana, L. WHITE ASH.

The bark is tonic, cathartic and diuretic.

Fraxinus quadrangulata, Michx. BLUE ASH.

The leaves have been used to some degree of success in gout. The bark is astringent and anti-periodic.

Fraxinus nigra, Marsh. BLACK ASH.

The bark is discutient, astringent, exanthematous and tonic.

Fraxinus pubescens, Lam. RED ASH.

The bark is astringent, tonic and anti-periodic.

Chionanthus Virginica, L. FRINGE–TREE.

The bark is aperient, alterative, diuretic, tonic and febrifuge.

Ligustrum vulgare, L. PRIVET.

The leaves, which have an astringent, bitter taste, and the flowers, which are fragrant, in the form of a decoction, have been used as a gargle in sore throat and aphthous and scorbutic ulceration of the mouth. The berries are cathartic and purgative, and death has resulted from eating them in several instances. They are sometimes used for dyeing purposes. The bark has the same properties as the leaves.

ORDER 82.

ARISTOLOCHIACEÆ. (BIRTHWORT FAMILY.)

Asarum Canadense, L. WILD GINGER, CANADA SNAKE-ROOT.

Asarum Virginicum, L. VIRGINIA WILD GINGER.

Asarum Macranthum, Shutt, Small. LARGE-FLOWERED WILD GINGER.

The roots of the above are an aromatic stimulant tonic, possessing diaphoretic properties, have been used as Virginia Snake-root or Serpentaria, as they resemble this article in their effects. They have been found diuretic.

Aristolochia Serpentaria, L. VIRGINIA SNAKE-ROOT.

Aristolochia macrophylla, Lam. DUTCHMAN'S PIPE.

Aristolochia tomentosa, Sims. WOOLLY PIPE-VINE.

All of the above have similar properties. The roots are a stimulant tonic, diaphoretic or diuretic. When too largely taken they cause nausea, vomiting, griping pains in the stomach and dysenterie tenesmus.

ORDER 83.

POLYGONACEÆ. (BUCKWHEAT FAMILY.)

Rumex Acetosella, L. FIELD OR SHEEP SORRELL.

The leaves have an agreeable sour taste, and are refrigerant and diuretic. If freely taken the leaves are said to produce poisonous effects.

Rumex hastatulus, Muhl. ENGLEMAN'S SORRELL.

The leaves are ascidious, refrigerant and anti-scorbutic.

Rumex crispus, L. CURLED OR YELLOW DOCK.

The root is astringent, gently tonic and alterative. This particular variety unites a laxative with the tonic and astringent property, and will be found to resemble rhubarb in its effects.

Rumex sanguineus, L. BLOODY OR RED-VEINED DOCK.

The root is depurient and a slow cathartic.

Fagopyrum Fagopyrum, L., Karst. BUCKWHEAT.

The seeds are esculient and nutritious.

Polygonum Persicaria, L. LADY'S THUMB, HEART'S EASE.

The herb is vulnerary and antiseptic.

Polygonum hydropiperoides, Michx. WILD WATER PEPPER.

The leaves are antiseptic, aperient and diuretic.

Polygonum Hydropiper, L. SMARTWEED, WATER PEPPER.

The leaves are acrid, pungent, antiseptic, aperient and diuretic.

Polygonum punctatum, Ell. DOTTED OR WATER SMARTWEED.

The herb is acrid, astringent, diuretic and diaphoretic.

Polygonum Virginianum, L. VIRGINIA KNOT-WEED.

The herb is vulnerary, tonic and anti-spasmodic.

Polygonum aviculare, L. KNOT-GRASS.

The root is astringent and vulnerary. The seeds are aromatic, purgative and emetic.

Polygonum convolvulus, L. BLACK BINDWEED.

The seed are used as buckwheat.

ORDER 84.

PHYTOLACCEÆ. (POKEWEED FAMILY.)

Phytolacca decandra, L. POKE, PIGEON-BERRY.

The leaves, berries and root are used, though the two latter are officinal, and the root is the most active. It is emetic, purgative and narcotic. As an emetic it is very slow in its action, but continues to act for a long time, both upon the stomach and bowels, causing pain or spasms. As a narcotic it produces drowsiness, vertigo and dimness of vision, followed by coma, and sometimes death. In small doses it is said to be alterative.

ORDER 85.

CHENOPODIACEÆ. (GOOSEFOOT FAMILY.)

Chenopodium album, L. LAMB'S QUARTERS, PIGWEED.

The leaves are anti-scorbutic.

Chenopodium Botrys. L. JERUSALEM OAK.

Chenopodium anthelminticum, L. WORMSEED.

Chenopodium ambrosioides, L. MEXICAN TEA.

All parts of these plants have been employed, but the seeds only are officinal. They are one of our most efficient authelmintics.

Salsola Kali, L. SALTWORT.

The herb is emmenagogue, stimulant, diuretic, hydragogue, and yields barilla.

ORDER 86.

AMARANTHACEÆ. (AMARANTH FAMILY.)

Amaranthus hybridus, L. SLENDER PIGWEED.

The leaves are astringent, and detergent.

Amaranthus græcizans, L. TUMBLE-WEED.

The herb is vulnerary, detergent and anti-phlogistic.

ORDER 87.

LAURACEÆ. (LAUREL FAMILY.)

Sassafras Sassafras, L., Karst. SASSAFRAS, AGUE TREE.

The pith abounds in a gummy matter, which it readily imparts to water, forming a limpid mucilage, which is much employed as a soothing application in inflammation of the eyes, and forms also an agreeable and useful drink in dysenteric, catarrhal and nephritic diseases. The bark of the root is stimulant and diaphoretic. It is used almost exclusively as an adjuvant to other more efficient medicines, its flavor rendering it more cordial to the stomach.

Benzoin Benzoin, L., Coulter. SPICE BUSH OR WOOD.

Benzoin melissæfolium, Walt., Nees. HAIRY SPICE-WOOD.

All parts of these shrubs have a spicy, agreeable flavor, which is strongest in the bark and berries. The small branches are often used as a stimulating aromatic in the form of infusion or decoction as a vermifuge and as an agreeable drink in low fevers. The bark has been used in intermittents.

ORDER 88.

LORANTHACEÆ. (MISTLETOE FAMILY.)

Phoradendron flavescens, Parsh, Nutt. AMERICAN MISTLETOE.

The whole herbaceous portion was once looked upon as powerfully anti-spasmodic, and highly esteemed as a remedy in epilepsy, palsy and other nervous diseases, but is now out of use. Numerous cases of children poisoned by eating the berries are on record. The prominent symptoms are vomiting and great thirst, followed by frequent bloody mucous discharge from the bowels, with tenesmus, and for these reasons they should be kept out of the reach of children.

ORDER 89.

SANTALACEÆ. (SANDLEWOOD FAMILY.)

Comandra umbellata, L., Nutt. BASTARD TOAD-FLAX.

The leaves are febrifuge and tonic.

Pyrularia pubera, Michx. OIL-NUT.

The nuts are oily, and are much eaten by cattle.

ORDER 90.

THYMELEACEÆ. (MEGEREON FAMILY.)

Dirca palustris, L. LEATHER-WOOD, MOOSE-WOOD.

The berries are narcotic and poisonous. The bark when chewed excites a flow of saliva, and in six to eight grain doses produces violent vomiting, preceded by a sense of heat in the stomach, and often followed by purging. Applied to the skin excites redness and vesicates, but its operation in this respect is very slow.

ORDER 91.

EUPHORBIACEÆ. (SPURGE FAMILY.)

Acalypha Virginica, L. VIRGINIA MERCURY.

The herb is expectorant and diuretic.

Ricinus communis, L. CASTOR–OIL PLANT.

The castor-oil of commerce is derived from the seeds of this plant. The seeds, if taken whole, are powerfully cathartic, and often emetic. Two of them will purge with great violence, and three of them are said to have caused death in the adult.

Stillingia sylvatica, L. QUEEN'S DELIGHT.

The root is emetic and cathartic; in smaller doses alterative, with some influence over the secretions.

Euphorbia maculata, L. SPOTTED SPURGE, MILK PARSLANE.

The herb has been used as a remedy in dysentery.

Euphorbia nutans, Laq. LARGE SPOTTED SPURGE.

Has identical properties to the above variety, and was once officinal, but its use has been abandoned in regular practice.

Euphorbia corollata, L. BLOOMING SPURGE.

The root is an active and certain emetic in full doses, often acting with considerable energy on the bowels. In smaller doses it causes nausea, followed by brisk purging. The recent root will produce vesication if applied to the skin. There is considerable danger incurred from the internal use of this root, and it should not be used locally.

Exphorbia Ipecacuanhæ, L. WILD IPECAC, IPECAC SPURGE.

The root has the properties of the above in a milder form, and like it, is attended with danger, liable to produce excessive nausea and vomiting, general prostration and alarming hypercatharsis.

Euphorbia Lathyris, L. CAPER OR MYRTLE SPURGE.

The oil from this plant is said to act on the system in the same manner as croton oil.

ORDER 92.

ULMACEÆ. (ELM FAMILY.)

Ulmus Americana, L. WHITE OR WATER ELM.

The inner bark is astringent, tonic, alterative and diuretic.

Ulmus alata, Michx. WINGED ELM.

The inner bark has been used as a poultice to inflamed parts.

Ulmus fulva, Michx. SLIPPERY OR RED ELM.

The inner bark is demulcent. Has been especially recommended in diarrhœa, dysentery and diseases of the urinary passages. The mucilage of this tree is very nutritious. It is commonly used as a drink in the form of infusion. The powdered bark, if mixed with hot water, will be found an excellent emollient in cases of external inflammation.

Celtis occidentalis, L. HACKBERRY, SUGAR-BERRY.

The bark is anodyne and refrigerant. The berries are sweet, astringent and anti-syphilitic.

ORDER 93.

MORACEÆ. (MULBERRY FAMILY.)

Morus rubra, L. RED MULBERRY.

Morus alba, L. WHITE MULBERRY.

Mulberries are refreshing and laxative, and make a grateful drink adapted to febrile cases.

Humulus Lupulus, L. HOP.

Hops are tonic and slightly narcotic. A pillow of them will often allay restlessness and produce sleep in nervous disorders.

Cannabis sativa, L. HEMP.

For the medicinal properties of this plant see Cannabis Indica.

ORDER 94.

URTICACEÆ. (NETTLE FAMILY.)

Urtica dioica, L. STINGING OR GREAT NETTLE

Urtica urens, L. SMALL NETTLE.

Both of these plants have similar properties. The herb was formerly thought diurectic and astringent.

Adicea purnila, L., Raf. CLEARWEED, STINGLESS NETTLE.

The leaves are demulcent in Rhus poisoning.

Parietaria Pennsylvanica, Muhl. PENN PELLITORY.

The herb is diuretic, deobstruent and emmenagogue.

ORDER 95.

PLATANACEÆ. (PLANE-TREE FAMILY.)

Platanus occidentalis, L. PLANE-TREE, SYCAMORE.

The leaves are ophthalmicum. The bark is anti-scorbutic.

ORDER 96.

JUGLANDACEÆ. (WALNUT FAMILY.)

Juglans nigra, L. BLACK WALNUT.

Juglans cinerea, L. BUTTERNUT, WHITE WALNUT.

The leaves of the above are moderately aromatic, bitter and astringent. The inner bark of the tree and root is a mild cathartic acting on the bowels without pain and without debilitating the alimentary canal.

Hicoria alba, L., Britton. WHITE-HEART HICKORY.

Hicoria laciniosa, Mich. f., Sarg. BIG SHAG-BARK, KING NUT.

Hicoria glabra, Mill., Britton. PIG NUT HICKORY.

The above have similar properties. The shells are astringent, and the bark is cathartic.

Hicoria ovata, Mill., Britton SHELL-BARK HICKORY.

The bark is cathartic, the leaves are mildly astringent, and the fruit is edible and diuretic.

Hicoria minima, Marsh., Britton. SWAMP HICKORY, BUTTER-NUT.

The bark is acrid and cathartic, and the fruit is edible and diuretic.

ORDER 97.

FAGACEÆ. (BEECH FAMILY.)

Fagus Americana, Sweet. AMERICAN BEECH.

The bark is astringent, tonic and antiseptic. Fruit edible.

Castanea vesca, L. SOUTHERN CHESTNUT.

Castanea dentata, Marsh., Borkh. AMERICAN CHESTNUT.

An infusion of the leaves has attained some notoriety in whooping-cough. The bark is astringent and tonic, and has been used in dysentery.

Castanea pumila, L., Mill. CHINQUAPIN.

The bark is astringent, tonic and febrifuge.

Quercus rubra, L. RED OAK.

The bark is astringent.

Quercus velutina, Lam. BLACK OAK.

The bark is tonic, astringent, bitter and febrifuge, but is not employed as an internal remedy.

Quercus digitata, Marsh., Sudw. SPANISH OAK.

The bark is quercitron in tanning, and has tonic properties.

Quercus nana, Marsh., Sarg. BEAR OAK.

The bark is astringent.

Quercus Marylandica, Maeuch. BARREN OAK.

The bark is bitter.

Quercus nigra, L. WATER OAK.

The bark is astringent and tonic.

Quercus alba, L. WHITE OAK.

Quercus Prinus, L. ROCK CHESTNUT OAK.

The bark of the above varieties is tonic, astringent and antiseptic.

ORDER 98.

BETULACEÆ. (BIRCH FAMILY.)

Carpinus Caroliniana, Walt. BLUE BEECH, AMERICAN HORNBEAM.

The leaves are a mild astringent.

Ostrya Virginiana, Mill., Willd. IRON-WOOD HOP-HORNBEAM.

The bark is bitter, tonic, alterative and anti-periodic.

Corylus Americana, Walt. HAZEL-NUT.

The fruit is edible, diuretic, anodyne and anthelmintic.

Corylus rostrata, Ait. BEAKED HAZEL-NUT.

The spicula have been employed as an anthelmintic.

Betula nigra, L. RIVER OR RED BIRCH.

Betula lenta, L. CHERRY, BLACK OR SWEET BIRCH.

The leaves and bark of the above varieties are aromatic, excitant, diaphoretic, stimulant and astringent. An aromatic oil is distilled from the branches and foliage of the latter (same as oil of wintergreen) and is an important article of commerce, and is sold on the market as oil of birch or wintergreen.

Alnus Alnobetula, Elrh., K. Koch. GREEN OR MOUNTAIN ALDER.

Alnus rugosa, Du Roi, K. Koch. SMOOTH OR RED ALDER.

The bark of the above is alterative, astringent and emetic. The cones are astringent. All parts may be used in dyeing, and the leaves and bark in tanning.

ORDER 99.

MYRICACEÆ. (BAYBERRY FAMILY.)

Myrica cerifera, L. WAX MYRTLE.

The bark is tonic, astringent, and in large doses emetic.

Myrica Carolinensis, Mill. WAXBERRY, BAYBERRY.

This and the above variety is the source of myrtle wax, which has been popularly employed as a remedy for dysentery.

Comptonia peregrina, L., Coulter. SWEET FERN.

All parts of this plant possess a resinous, spicy odor, which is increased if the plant is rubbed, and a decoction of it is occasionally used in diarrhœa and various other complaints calling for a tonic and astringent.

ORDER 100.

SALICACEÆ. (WILLOW FAMILY.)

Populus balsamifera.

The bark is stimulant, tonic, diuretic and anti-scorbutic. The buds are vulnerary and balsamic.

Populus deltoides, Marsh. COTTONWOOD, CAROLINA POPLAR.

The bark is astringent, tonic and bitter.

Populus grandidentata, Michx. LARGE-TOOTHED ASPEN.

The bark is tonic, stomachic, febrifuge and anti-periodic.

Salix nigra, Marsh. BLACK WILLOW.

The bark is bitter, astringent, antiseptic, detergent and anti-periodic. The buds are anti-aphrodisiac.

Salix purpurea, L. PURPLE WILLOW.

Escaped from cultivation in some sections. The bark is bitter.

ORDER 101.

SAURURACEÆ. (LIZARD'S TAIL FAMILY.)

Saururus cernuus, L. LIZARD'S TAIL, BREAST-WEED.

The herb is laxative, sedative, anti-spasmodic and slightly astringent. The root is said to be emolient and discutient.

ORDER 102.

CALLITRICHACEÆ. (WATER STARWORT FAMILY.)

Callitriche. L., Palustris. WATER-STARWORT.

The herb is diuretic.

ORDER 103.

CERATOPHYLLACEÆ. (HORN-WORT FAMILY.)

Ceratophyllum demersum, L. HORNWORT.

The herb is demulcent and emollient.

ORDER 104.

PINACEÆ. (PINE FAMILY, CONIFERS.)

Pinus Strobus, L. WHITE PINE.

One of our most valuable timber trees, yielding Gum Thus.

Pinus palustris, Mill. LONG-LEAVED PINE, GEORGIA PINE.

Yields Gum Thus, turpentine and tar.

Pinus Tæda, L. LOBLOLLY PINE, OLD–FIELD PINE.

Yields common pine resin.

Pinus rigida, Mill. PITCH PINE, TORCH PINE.

Yields tar, pitch and turpentine.

Picea Mariana, Mill., B. S. P. BLACK SPRUCE.

The bark is alterative, diuretic and stimulant. The gum is stimulant and diuretic. An essence prepared from the young branches by boiling them in water and evaporating the decoction, is used in the preparation of *spruce beer*, which is a pleasant and wholesome drink in summer and is useful as a preventive of scurvy.

Tsuga Canadensis, L., Carr. HEMLOCK.

The bark is astringent and diaphoretic. The leaves are abortive. The gum is stimulant, diuretic and rubefacient. The bark is largely used in tanning.

Tsuga Caroliniana, Eugelm. CAROLINA HEMLOCK.

The bark and gum derived from this graceful tree is collected and sold as the above variety and doubtless has similar properties.

Abies balsamea, L., Mill. BALSAM FIR.

The Canada balsam of commerce is derived from the resinous exudations of the trunk. The bark is stimulant, diuretic, anthelmintic, detergent and vulnerary.

Abies Fraseri, Porsh.. Lindl. FRASER'S BALSAM FIR.

The balsam obtained from the above is often adulterated with the product obtained from this tree, and the bark is said to be treated likewise.

Taxodium distichum, L., L. C. Rich. BALD CYPRESS.

The resin is diuretic, carminative and vulnerary.

Thuja occidentalis, L. (Cultivated) WHITE CEDAR, ARBOR VITÆ.

The leaves and small twigs, in the form of a decoction, have been used in coughs, fevers, scurvy and rheumatism. A saturated tincture has been found useful as an emmenagogue.

Chamaecyparis thyoides, L., B. S. P. SOUTHERN WHITE CEDAR.

The leaves are stimulant, aromatic, diaphoretic and stomachic.

Juniperus Virginiana, L. RED CEDAR, SAVIN.

The leaves are stimulant, diuretic and emmenagogue. The excrescences caused by fungus growth are said to be antelmintic.

ORDER 105.

TAXACEÆ. (YEW FAMILY.)

Taxus minor, Michx., Britton. AMERICAN YEW, GROUND HEMLOCK.

The leaves are sedative, and are said to act as Digitalis.

ORDER 106.

PALMACEÆ.

Sabal Palmetto, Loddig. PALMETTO.

Sabal Adonsonii, Guerns. DWARF PALMETTO.

The buds are eaten as salad. The berries have medicinal properties, but not definitely determined.

ORDER 107.

ARACEÆ. (ARUM FAMILY.)

Arisæma triphyllum, L., Torr. INDIAN TURNIP.

All parts of this plant are highly acrid, but the root alone is the officinal part. In the fresh state it is violently acrid, and when chewed produces an insupportable burning and biting sensation in the mouth and throat, which continues for a long time. It possesses the property of stimulating the secretions of the skin and lungs.

Arisaema Dracontium, L., Schoot. GREEN DRAGON.

The root of this plant is collected and sold as the preceding, and has similar properties in a milder form.

Peltandra Virginica, L., Kenth. GREEN ARROW-ARUM.

The root is acrid, stimulant and irritant.

Spathyema foetida, L., Raf. SKUNK CABBAGE.

The root is stimulant, anti-spasmodic, narcotic and expectorant.

Orontium aquaticum, L. GOLDEN-CLUB.

The seed are acrid and edible.

Acorus Calamus, L. SWEET FLAG, CALAMUS-ROOT.

The root is the officinal part, and is a stimulant tonic, having the virtues of the aromatics.

ORDER 108.

LEMNACEÆ. (DUCKWEED FAMILY.)

Lemna minor, L. LESSER DUCKWEED.

The whole plant is demulcent, and used in poultices.

ORDER 109.

TYPHACEÆ. (CAT-TAIL FAMILY.)

Typha latifolia, L. BROAD-LEAVED CAT-TAIL.

Typha angustifolia, L. NARROW-LEAVED CAT-TAIL.

The roots of the above varieties are astringent and emollient. The down is often applied to burns.

ORDER 110.

NAIADACEÆ. (POND-WEED FAMILY.)

Ruppia maritima, L. DITCH-GRASS, MARITIME RUPPIA.

The herb is vulnerary and depurient.

ORDER 111.

ALISMACEÆ. (WATER-PLANTAIN FAMILY.)

Alisma Plantago-aquatica, L. WATER PLANTAIN.

The leaves are vescicant, diuretic and lithrontryptic.

Sagittaria latifolia, Willd. BROAD-LEAVED ARROW-HEAD.

The root yields fecula. The leaves dispel milk.

ORDER 112.

VALLISNERIACEÆ. (TAPE-GRASS FAMILY.)

Vallisneria spiralis, L. TAPE-GRASS, EEL-GRASS.

The herb is refrigerant and demulcent.

ORDER 113.

ORCHIDACEÆ. (ORCHID FAMILY.)

Cypripedium acuale, Ait. MOCCASIN FLOWER, STEMLESS LADIES SLIPPER.

Cypripedium reginal, Walt. SHOWY LADIES SLIPPER.

Cypripedium hirsutum, Mill. LARGE YELLOW LADIES SLIPPER.

Cypripedium parviflorum, Salisb. SMALL YELLOW LADIES SLIPPER.

The roots of the above varieties are collected and sold in this

State as one and the same thing. They appear to be a gentle nervous stimulant or anti-spasmodic, and have been used similarly to valerian, though they are less powerful.

Orchis spectabilis, L. Showy Orchis.

The root yields salep.

Habenaria bracteata, Willd., R. Br. Long-bracted Orchis.

The root is mucilagenous and emollient.

Peramium repens, L., Salisb. Lesser Rattlesnake Plantain, Net-leaf.

Peramium pubescens, Willd., MacM. Downy Rattlesnake Plantain, Net-leaf.

The herb is anti-scrofulous, demulcent.

Corallorhiza odontorhiza, Willd., Nutt. Crawley, Coral-root.

The root is considered an energetic diaphoretic, and being destitute of general stimulant properties, is supposed to be useful in fevers and inflammatory affections.

Aplectrum spicatum, Walt., B. S. P. Adam and Eve, Patty-root.

The root is mucilagenous and pectoral.

ORDER 114.

AMARYLLIDACEÆ. (AMGRYLLIS FAMILY.)

Zephyranthes Atamasco, L., Herb. Atamasco Lily.

The root is acrid.

Agave Virginica, L. False Aloe.

The root is bitter and carminative.

Hypoxis hirsuta, L., Coville. Star-grass.

The root is detergent and vulnerary.

ORDER 115.

HAEMODORACEÆ. (BLOODWORT FAMILY.)

Gyrotheca capitata, Walt., Moring. Spirit-weed, Red-root.

The herb is stimulant.

ORDER 116.

BROMELIACEÆ. (PINE-APPLE FAMILY.)

Tillandsia asneoides, L. Long or Florida Moss.

This so-called moss has been mixed with lard in the form of poultice and used in piles.

ORDER 117.

IRIDACEÆ. (IRIS FAMILY.)

Iris versicolor, L. LARGER BLUE FLAG.

Iris Caroliniana, S. Wat. CAROLINA BLUE FLAG.

Iris prismatica, Parsh. SLENDER BLUE FLAG.

Iris verna, L. DWARF IRIS.

The roots of the above varieties are collected and sold as the same thing in this State. They are cathartic, emetic, diuretic and purgative.

Gemmingia Chinensis, L., Kuntze. BLACKBERRY LILY.

The bulbs are drastic and diuretic.

Sisyrinchium graminoides, Bicknell. STOUT BLUE-EYED GRASS.

Sisyrinchium Atlanticum, Bicknell. EASTERN BLUE-EYED GRASS.

The roots of the above are acrid and cathartic.

ORDER 118.

DIOSCOREACÆ. (YAM FAMILY.)

Dioscorea villosa, L. WILD YAM-ROOT.

The root is anti-spasmodic, diaphoretic.

ORDER 119.

SMILACEÆ. (SMILAX FAMILY.)

Smilax herbacea, L. CARRION-FLOWER.

The root and stems are diuretic, alterative and emmenagogue.

Smilax tamnifolia, Michx. HALBERT-LEAVED SMILAX.

The root is depurient and alterative.

Smilax glauca, Walt. GLANCOUS-LEAVED GREENBRIER.

The root is alterative, diuretic, demulcent and anti-syphilitic.

Smilax Pseudo-China, L. LONG-STALKED GREENBRIER.

The root is depurient, alterative, diuretic and anti-syphilitic.

ORDER 120.

LILIACEÆ. (LILY FAMILY.)

Allium mutabile, Michx. WILD ONION.

Allium tricoccum, Ait. WILD LEEK.

Allium vineale, L. WILD GARLIC.

Allium Canadense, L. MEADOW GARLIC.

Allium cernuum.

The bulbs of the above are stimulant, diuretic, expectorant, diaphoretic and anthelmintic.

Lilium Canadense, L. Wild Yellow or Canada Lily.

The root is cathartic, the leaves are refrigerant.

Erythronium Americanum, Ker. Yellow Adder's-tongue.

The herb is emetic, emollient and anti-scrofulous.

Quamasia hyacintheria, Raf., Britton. Wild Hyacinth.

The root is esculent and emollient.

Aletris farinosa, L. Star-grass, Colic-root.
Aletris aurea, Walt. Yellow Colic-root.

The roots of the above are bitter, tonic, stomachic.

Yucca filamentosa, L. Adam's Needle.

The root is said to be anti-syphilitic.

ORDER 121.

CONVALLARIACEÆ. (LILY-OF-THE-VALLEY FAMILY.)

Asparagus officinalis, L. Asparagus.

The young shoots are diuretic and aperient.

Vagnera racemosa, L., Morong. Small Solomon's Seal, Wild Spikenard.

The root is astringent, tonic, mucilagenous, expectorant.

Polygonatum biflorum, Walt., Ell. Hairy Solomon's Seal.

The root is stimulant.

Convallaria majalis, L. Lily-of-the-Valley.

The root is mucilagenous and sweet.

Medeola Virginiana, L. Indian Cucumber-root.

The root is diuretic, cathartic.

Trillium sessile, L. Sessile-flowered Wake-robin, Bett-root.
Trillium grandiflorum, Michx., Salisb. Large-flowered Wake-robin, Bett-root.
Trillium erectum, L. Ill-scented Wake-robin, Bett-root.
Trillium cernuum, L. Nodding Wake-robin, Bett-root.
Trillium undulatum, Willd. Painted Wake-robin, Bett-root.

All of the above are collected and sold in this State under one name. The roots are astringent, tonic, anti-septic, emmenagogue, expectorant, diaphoretic and alterative.

ORDER 122.

MELANTHACEÆ. (BUNCH-FLOWER FAMILY.)

Chamaelirium luteum, L., A. Gray. UNICONE–ROOT.

The root is alterative, tonic, diuretic, emmenagogue, vermifuge.

Chrosperma muscaetoxicum, Walt., Kuntze. FLY–POISON.

The bulbs with honey is an excellent fly poison.

Melanthium Virginicum, L. BUNCH–FLOWER.

The root is a crow and fly-poison.

Melanthium latifolium, Desr. CRISPED BUNCH–FLOWER.

The plant and flower are poisonous.

Veratrum viride, Ait. AMERICAN WHITE HELLEBORE.

The root is a violent and dangerous emetic and cathartic.

Uvularia perfoliata, L. PERFOLIATE BELLWORT.

Uvularia grandiflora, J. E. Smith. LARGE–FLOWERED BELLWORT.

Uvularia sessilifolia, L. SESSILE–LEAVED BELLWORT.

Uvularia puberula, Michx. MOUNTAIN BELLWORT.

The herb of the above varieties are tonic, demulcent, nervine.

ORDER 123.

JUNCACEÆ.

Juncus effusus, L. COMMON OR BOG RUSH.

Juncus bufonius, L. TOAD RUSH.

The herbs of the above are diuretic and cathartic.

ORDER 124.

PONTEDERIACEÆ. (PICKEREL-WEED FAMILY.)

Pontedera cordata, L. PICKEREL–WEED.

The leaves are diuretic and cathartic.

ORDER 125.

COMMELINACEÆ. (SPIDERWORT FAMILY.)

Tradescantia Virginiana, L. SPIDERWORT.

The root is demulcent.

ORDER 126.

XYRIDACEÆ. (YELLOW-EYED GRASS FAMILY.)

Xyris Caroliniana, Walt. CAROLINA YELLOW–EYED GRASS.

The herb has been used in cutaneous complaints.

ORDER 127.

CYPERACEÆ. (SEDGE FAMILY.)

Scirpus lacustris, L. GREAT BULRUSH.

The seeds are diuretic, emmenagogue and astringent.

ORDER 128.

GRAMINAEÆ. (GRASS FAMILY.)

Anthoxanthum odoratum, L. SWEET VERNAL-GRASS.

The herb is aromatic and fragrant.

Phragmites Phragmites, L., Karst. REED.

The roots are diuretic and depurient.

Bromus ciliatus, L. BROOM-GRASS, WOOD CHESS.

The herb is emetic, anthelmintic, diuretic and cathartic.

Bromus secalinus, L. CHEAT, CHESS.

The seeds are purgative.

FERN ALLIANCE.

ORDER 1.

OPHIOGLOSSACEÆ. (ADDER'S-TONGUE FAMILY.)

Botrychium ternatum, Thumb., S. W. TERNATE GRAPE-FERN.

Botrychium Virginianum, L., S. W. RATTLESNAKE'S GRAPE-FERN.

The leaves are astringent and vulnerary.

ORDER 2.

OSMUNDACEÆ. (ROYAL FERN FAMILY.)

Osmunda regalis, L. ROYAL FERN.

Osmunda cinnamomea, L. CINNAMON FERN.

The roots are astringent, tonic, styptic, mucilagenous.

ORDER 3.

POLYPODIACEÆ. (FERN FAMILY.)

Cystopteris fragilis, L., Bernh. BRITTLE FERN.

Asplenium Trichomanes, L. MAIDEN-HAIR SPLEENWORT.

Adiatum Capillus-Veneris, L. VENUS-HAIR FERN.

Adiatum pedatum, L. MAIDEN-HAIR FERN.

The whole herb of the above varieties is pectoral, mucilagenous, expectorant, refrigerant and tonic.

Dryopteris marginalis, L., A. Gray. EVERGREEN WOOD-FERN.
Dryopteris Filix-mas, L., Schott. MALE FERN.
Asplenium Felix-foemina, L., Beruh. LADY FERN.

The roots of the above are astringent and anthelmintic.

Woodwardia Virginica, L., J. E. Smith. VIRGINIA CHAIN-FERN.

The leaves are astringent.

Scolopendrium Scolopendrium,, L., Karst. HART'S-TONGUE.

The leaves are astringent, pectoral and vulnerary.

Comptosorus rhizophyllum, L., Laik. WALKING-FERN.

The herb is tonic, sub-astringent and mucilagenous.

Asplenium Ruta-mariana, L. WALL RUE SPLEENWORT.

The root is anthelmintic and astringent.

Pteris aquilina, L. BRAKE.

The root is anthelmintic.

Pellaea atropurpurea, L., Laik. PURPLE-STEMMED CLIFF-BRAKE.

The herb is astringent, anthelmintic.

Polypodium vulgare, L. COMMON POLYPODY.
Polypodium polypodioides, L., A. S. H. GRAY POLYPODY.

The herb is diuretic, purgative, cholagogue and sacchariner.

TABLE OF CORRECTIONS.

On page 331 omit c in Ranunculaceæ.

Tn page 331 *Crispa* should read *crispa.*

On page 331 *Ochrolenca* should read *ochroleuca.*

On page 331 *Quinquefolia* should read *quinquefolia.*

On page 331 *Trifolia* should read *trifolia.*

On page 333 *Aquatilis* should read *aquatilis.*

On page 335 Dunai should read Duval.

On page 336, *Vulgaris* should read *vulgaris.*

On page 336, *Thalictroides* should read *thalictroides.*

On page 336, *Cymosa* should read *cymosa.*

On page 336, omit having acridid principles.

On page 340, *Camelina* should read *Comelina.*

On page 340, S should read L.

On page 342, *Majus* should read *majus.*

On page 343, omit *?* after *ovata.*

On page 348, omit *?* after *toxicodendron.*

On page 350, Dripacea should read Drupacea.

On page 353, *striatgosus* should read *strigosus.*

On page 357, *Pastniaca* should read *Pastinaca.*

On page 358, *Ciucta* should read *Cicuta.*

On page 361, omit c in Rubicaceæ.

On page 365, read *Tanacetum* for *Tauacetum.*

On page 368, read *angustifolia* for *augustifolia.*

On page 372, read *Tecoma radicans* for *Bignonia* (*Tecoma*) *radicans.*

On page 373, read *sempervirens* for *sempervireus.*

On page 374, read *officinalis* for *officinals.*

On page 379, read Convolvulaceæ for convolonlaceæ.

On page 379, read *pubescens* for *pubeescens.*

On page 386, read *pumila* for *purnila.*

On page 389, read *cernuus* for *cerncuus.*

On page 389, read *Callitriche palustris*, L. for *Callitriche.* L., Palustris.

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RALEIGH, N. C.

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MRS. L. V. DARBY	Stenographer.

The Director's office is in the main building of the College. Telephone No. 135 C. The street cars pass within one hundred yards of the College building.

The Station is glad to receive any inquiries on agricultural subjects. *Address all communications to the Agricultural Experiment Station, and not to individuals.* They will be referred to the members of the Station staff most competent to answer them.

THE FERTILIZER CONTROL FOR 1897.

W. A. WITHERS, Chemist and Acting Director.

INTRODUCTION.

It was the custom of the Experiment Station for many years, to publish under its own auspices, the results of the analyses by members of its staff, of the samples of fertilizers taken by the different Inspectors under the supervision of the Commissioner of Agriculture, from lots on sale in the State.

When the existing agreement was entered into between the Board of Commissioners of the Department of Agriculture and the Board of Control of the Experiment Station, it was made a condition that the Commissioner of Agriculture should have the exclusive publication of the results of the analyses. In consequence the individual results of the analyses are not included in this bulletin which it is deemed proper should be published for the information of those interested in the fertilizer industry, either as manufacturers, agents or consumers.

The analytical work was performed from January 1st to July 1st by Messrs Kilgore, Allen, Miller and Asbury, under the direction of Dr. Battle and for the remainder of the year, by Messrs Williams, Miller, Harris and Blair, under the direction of the author.

Acknowledgment is also made to Commissioner Smith and Secretary Ramsey of the Department of Agriculture for valuable information furnished by them.

PUBLICATIONS DURING 1897, CONTAINING FERTILIZER ANALYSES.

The analyses were published as follows :

Special bulletins of the Experiment Station, No. 40, February 20; No. 41, March 6; No. 42, March 20; No. 43, April 3; No. 44, April 17; No. 45, May 1; No. 46, May 22; No. 47, June 26, 1897.

The Bulletin of the North Carolina Department of Agriculture March, April, June and July, 1897.

The Bulletin of the Agricultural Experiment Station of North Carolina, published under the supervision of the Department of Agriculture for September, October, November and December, 1897.

RELATION OF THE STATION TO THE FERTILIZER CONTROL.

According to the terms of the contract previously referred to between the Department of Agriculture and the Experiment Station, the Experiment Station has no responsibility for any part of the Fertilizer Control work, except as to the correctness of the analyses of the samples furnished by the Commissioner. These samples are received by the Experiment Station in glass bottles bearing the private seal of the inspector and having a number by which they are identified. The name of the brand, manufacturer, place at which sample was taken, etc., are withheld from the Experiment Station until the completion of the analysis and the filing of a report of the same with the Commissioner of Agriculture, who then publishes the information in full.

The collection of the samples and the publishing of the results is entirely in the hands of the Commissioner, who is the agent of the Department of Agriculture.

INCREASE OF NUMBER OF BRANDS AND THE DIFFICULTY IN A PROPER CONTROL.

During the year 1890, the last year during which we had a tax for each brand, there were eighty-four brands of commercial fertilizers licensed to be sold in North Carolina. As there was a tax for each brand of $500 per annum, it was always true that a considerable quantity of each brand of fertilizer was sold, or it was hoped by each manufacturer that such would be the case. With a small number of brands, and with large quantities of each brand, it was not difficult to collect samples of each, and to complete analyses of these with promptness. During the year 1897 there were 673 brands registered, and the Commissioner of Agriculture furnished for analysis samples of 336 brands, leaving 337 of which no analyses were made. During the year 1896, there were 344 brands, out of a total of 666 registered, which were not analyzed, and during the year 1895 there were 266 brands, out of a total of 541 registered, which were not analyzed.

For each of the past three years, therefore, samples of only about fifty per cent. of the licensed brands have been analyzed.

It is impossible for us to say whether the brands which were not sampled were actually on sale in the State. As there is no limit to the number of brands, it is quite possible that in order to meet the varied demands which may be made by the possible consumers, many brands are registered of which there is no sale.

FIRMS WHICH REGISTERED BRANDS FOR SALE IN NORTH CAROLINA DURING 1897.

NAME.	ADDRESS.	Superphosphates.	Superphosphates with Potash.	Ammoniated Superphosphates.	Ammoni't'd Superphosphates with Potash.	Miscellaneous.	Total.
Acme Manufacturing Co	Wilmington, N. C.	1			4	1	6
American Fertilizing Co	Norfolk, Va	3	1	1	8	6	19
Armour Packing Co	Kansas City, Mo			4	6	3	13
Armour Fertilizing Works	Chicago, Ill.				9	3	12
Arps, Geo. L. & Co	Norfolk, Va				1		1
Ashepoo Phosphate Co	Charleston, S. C	5	1		5	2	13
Baltimore Guano Co	Baltimore, Md				2		2
Baltimore Pulverizing Co	Baltimore, Md				2		2
Baugh & Sons Co	Baltimore, Philad'a and Norfolk.	1		4	9	6	20
Beam, J. H	Lattimore, N. C	1	1		2		4
Bell, Westbrook & Co	Beaufort, N. C					1	1
Berkeley Phosphate Co	Charleston, S. C	1	1		1		3
Bonday, Jas., Jr. & Co	Baltimore, Md					4	4
Boykin, Carmer & Co	Baltimore, Md			1		2	3
Boykin & Stanley	Baltimore, Md			1	2	2	5
Bradley Fertilizer Co	Boston, Mass				3		3
Bragaw, Wm. & Co	Washington, N. C					1	1
Branch, A. P	Wilson, N. C				1		1
Buxton & Baughm	Rich Square, N. C				1		1
Calder Bros	Wilmington, N. C					1	1
Caraleigh Phosphate and Fertilizer Works.	Raleigh, N. C	3	1		6	1	11
Charlotte Oil and Fert. Co	Charlotte, N. C	3	2		9		14
Chemical Co. of Canton	Baltimore, Md	1	1		5	4	11
Chicora Fertilizer Co	Charleston, S. C	8	5		5	1	19
Clement, Carrington & Co	Lynchburg, Va				3		3
Columbia Guano Co	Norfolk, Va	3	1		5	1	10
Darlington Phosphate Co	Darlington, S. C	4	2		3	3	12
Detrick Fert. and Chem. Co	Baltimore, Md	2		1			3
Detrick, L. F	Baltimore, Md				1		1
Dey Bros	Beaufort, N. C.					1	1
Edisto Phosphate Co	Charleston, S. C	2	1		4	1	8
Etiwan Phosphate Co	Charleston, S. C	4	2		8	1	15
Fowler, Cowell & Co	Bayboro, N. C.				3		3
Garrell, J. F. & Co	Wilmington, N. C	1		1	11	1	14
Goldsboro Oil Co	Goldsboro, N. C				3		3
Great Eastern Fertilizer Co	New York, N. Y				4		4
Greenville Fertilizer Co	Greenville, S. C	1	1		2		4
Griffith & Boyd	Baltimore, Md				3	1	4
Harrell, S. B. & Co	Norfolk, Va				1		1
Hill, Jno. R	South Boston, Va				2		2
Hine, E. J. & Sons	Salem, N. C					1	1
Holmes & Dawson	Norfolk, Va				2		2
Hubbard, M. P. & Co	Baltimore, Md				1		1
Idol, W. H. & Co	Jamestown, N. C					1	1
Imperial Co	Norfolk, Va	1			6	1	8
Imperial Fertilizer Co	Charleston, S. C	3	4		5	1	13
Lazaretto Guano Go	Baltimore, Md	1			12		13
Leak, J. R	Rich Square, N. C				1		1

FIRMS WHICH REGISTERED BRANDS IN NORTH CAROLINA—Continued.

NAME.	ADDRESS.	Superphosphates.	Superphosphates with Potash.	Ammoniated Superphosphates.	Ammoni't'd Superphosphates with Potash.	Miscellaneous.	Total.
Lee, A. S. & Son	Richmond, Va	...	2	...	...	1	3
Lister's Agricult'l Chem. Wk's	Newark, N. J	...	...	...	2	...	2
McNair, J. F	Wilmington, N. C	1	..	..	1	...	2
Mapes Formula and Peruvian Guano Co.	New York, N. Y	...	..	...	6	...	6
MacMurphy, W. C. & Co	Charleston, S. C	1	...	...	10	5	16
Marlboro Mill Co	Bennettsville, S. C	...		...	...	1	1
Meadows E. H. & J. A. Co.	Newbern, N. C	1	1	1	7	1	11
Montgomery & Harrell	Norfolk, Va.	...	...	...	1	...	1
Navassa Guano Co	Wilmington, N. C	4	7	...	19	3	33
Norfolk Fertilizing Co	Norfolk, Va.	...	...	...	5	...	5
N. C. Cotton Oil Co	Raleigh, N. C	...	..	..	2	...	2
Ober, G. & Sons Co	Baltimore, Md	1	1	...	5	...	7
Patapsco Guano Co	Baltimore, Md	1	...	...	4	1	6
Piedmont-Mt. Airy Guano Co.	Baltimore, Md	2	1	...	10	1	14
Pocomoke Guano Co	Norfolk, Va	1	1	...	7	1	10
Powers, Gibbs & Co.	Wilmington, N. C	9	5	...	15	4	33
Quinnipiac Co	New York, N. Y	..	...	...	1	...	1
Ragsdale & Smith	Jamestown, N. C	..	...	...	...	1	1
Raisin Fertilizer Co	Baltimore, Md	1	1	...	4	...	6
Reese, John S. & Co.	Baltimore, Md	...	...	...	1	...	1
Reidsville Fertilizer Co	Reidsville, N. C	1	...	...	5		6
Richmond Guano Co	Richmond, Va	3	...		3	1	7
Royster, F. S. Guano Co	Tarboro, N. C., and Norfolk, Va.	2	2	...	7	1	12
Royster, F. S. Guano Co	Tarboro, N. C	...	...	...	1	1	2
Slingluff & Co	Baltimore, Md	...	...	..	1	...	1
Standard Fertilizer Mfg. Co.	Charleston, S. C	5	4	...	7	1	17
Stono Phosphate Works	Charleston, S. C	2	1	...	3	1	7
Sweet, R. N	Wilmington, N. C	...	...	...	...	1	1
Vann, S. C.	Franklinton, N. C	...	...		1	...	1
Virginia-Carolina Chem. Co	Richmond, Va	28	16	1	82	3	130
Wagener, T. W. & Co	Charleston, S. C	1	1	...	2	1	5
Walker, Joshua	Baltimore, Md	1	...	...	1	...	2
Wando Phosphate Co.	Charleston, S. C	1	1	..	2	1	5
Ward, S. H. & Sons	Jamestown, N. C	..	...	...	...	1	1
Warriner, W. H. & Co	Ruffin, N. C	...	...	...	1	...	1
Weil, H. & Bro's	Goldsboro, N. C	...	...	...	...	1	1
Wood, T. W. & Sons	Richmond, Va	...	1	2	4	...	7
Wooldridge, Robt. A. Co	Baltimore, Md	...	...	...	4	...	4
Zell Guano Co	Baltimore, Md	1	...	..	3	...	4
Total		116	69	17	388	83	673

EXTENT AND DISTRIBUTION OF THE TRADE.

The number of brands on sale in the State during the year 1897, was greater than for the year 1896, or for any previous year. The accompanying table shows the number of brands licensed each year for the past twelve years:

	1885	1886	1887	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897
Acid phosphates or simple superphosphates	9	11	10	9	12	16	59	81	86	86	150	107	116
Superphosphates with potash	10	9	8	7	5	4	13	24	22	24	36	68	69
Ammoniated superphosphates with potash	63	66	58	62	62	63	178	232	264	284	330	398	388
Ammoniated superphosphates	....	..	....	....	..	...	15	12	5	12	11	12	17
Kainit	....	....	....	....	...	....	19	25	29	35	38	34	33
Other potash salts and chemicals	...	....	....	....	....	....	3	4	6	6	4	13	10
Animal bone	....	....	....	....	....	...	....	....	3	3	9	16	12
Fish scrap	....	....	....	....	....	....	4	5	4	2	4	8	4
Miscellaneous	3	4	1	1	2	1	4	6	8	10	4	10	24
Totals	85	90	77	79	81	84	295	389	427	462	541	666	673

Attention has been called in previous Reports to the fact that since 1891 we have had a tonnage tax instead of a brand tax. This change in the law has doubtless had the effect of increasing the number of brands very largely. It is to be noted also that there has been an increase in the amount of commercial fertilizers consumed in the State. The Department estimates that during 1897 about 208,000 tons of commercial fertilizers were sold to parties in North Carolina. This estimate is based on the number of tags sold for the year. From this should be subtracted the number of tons corresponding to the unused tags in the hands of manufacturers at the end of the year. To this estimate should be added the number of tags corresponding to the tags purchased in former years and used during 1897—together with the tons illegally sold without tags attached. These three items are probably small—at any rate we have no means of estimating them. The estimate for the year 1896 was 187,000 tons and for 1895 about 111,000 and for 1894 about 131,000 tons.

The number of brands has increased each year over the previous year as follows:

In the year 1892, increase over the previous year.....	101
In the year 1893, increase over the previous year.....	29
In the year 1894, increase over the previous year.....	36

In the year 1895, increase over the previous year.....	80
In the year 1896, increase over the previous year.....	125
In the year 1897, increase over the previous year.....	7

The number of brands accredited to the several States is shown in the following table:

	1885	1886	1887	1888	1889	1890	1892	1893	1894	1895	1896	1897
Massachusetts..........	3	1	4	7	2	2	3	3	3	3	3	3
Connecticutt............	3	1	2	1	1	1	...	....	....	....	...	....
New York	4	3	1	1	2	1	8	10	8	7	9	11
New Jersey.............	2	3	2	4	4	5	3	7	2	2	1	2
Delaware	4	4	4	3	3	3	...	5	6	2	....	....
Maryland..............	31	35	29	25	28	25	98	104	93	88	100	94
Pennsylvania	....	1	....	1	....	....	5	12	7	6	....	....
Virginia................	18	21	14	12	12	16	96	106	146	189	213	214
North Carolina....... ..	9	10	11	13	14	18	78	89	98	137	166	186
South Carolina..........	11	11	10	13	15	13	85	82	97	96	153	138
Georgia	....	..	....	....	....	....	13	7	1	....	....	...
Missouri...............	....	....	....	....	....	....	...	....	1	11	11	13
Illinois	....	....	....	....	....	....	....	....	....	...	10	12
Totals...........	85	90	77	79	81	84	389	427	462	541	666	673

Assuming that there is a close relation between the number of brands manufactured in each State and the number of tons of fertilizers sold by each State, the table furnishes an interesting basis of comparison as to what extent the trade of manufacturing is distributed among the several States. .

We have calculated the distribution of the trade for 1897 among the different States upon the basis of tags sold, and have given the calculations upon the different bases for comparison. We insert in the following table, also some other comparative figures for 1897:

STATE.	NO. OF TONS TAXED.		NO. OF BRANDS.		NO. OF FIRMS.		Average No. of Brands Per Firm.	Average No. of Tons Per Firm.	Average No. of Tons Per Brand.
	Number.	Per Cent. of Total.	Number.	Per Cent. of Total.	Number.	Per Cent. of Total.			
Illinois	200.0	.1	12.	1.79	1.	1.15	12.	200.	16.6
Maryland.	13482.8	6.4	94.	13.97	20.	23 00	4.7	674.1	143.4
Massachusetts..	0.	......	3.	.44	1.	1.15	3.	.....	......
Missouri	39.	......	13.	1.93	1.	1.15	13.	39.	3.
New Jersey	2300.	1.1	2.	.30	1.	1.15	2.	2300.	1150.
New York......	50.	....	11.	1.63	3.	3.44	3.6	16.6	4.5
North Carolina.	87824.2	42.2	186.	27.64	30.	34.48	6.2	2927.4	472.1
South Carolina.	12809.	6.2	138.	20.50	14.	16.09	9.9	914.9	92.8
Virginia.......	91461.2	44.	214.	31.80	16.	18.39	13 3	5716.3	427.3
	208166.2	100.00	673.	100.00	87.	100.00	7.7	2392.7	309.3

VALUATION OF FERTILIZERS AND HOW THEY ARE DETERMINED.

The valuations of the three constituents—available phosphoric acid, ammonia, and potash—are intended to give the market price for cash at the seaboard of the ingredients making up the fertilizer. The cash prices for small lots in bags, free on board cars, are intended. These valuations are made up early in January of each year, to run through the spring and fall seasons. It is expected that there will be variations in the market price of the ingredients during the year, but this variation usually is not great. This is because fertilizing materials are largely contracted for in advance before the opening of the year, and in most cases the ingredients have already been wholly purchased and the fertilizers already manipulated before the beginning of the season.

The valuations of the constituents are fixed by careful examinations of existing trade conditions, the markets at important centres, and from actual quotations given by seaboard manufacturers and dealers upon various ingredients used for manipulating fertilizers. These quotations are for cash in small lots, free on board and bagged.

The relative commercial valuation given to the three valuable ingredients for the year 1897 was—

For available phosphoric acid........	4	cents	per	pound.
For ammonia..................................	12	"	"	"
For potash	5	"	"	"

For 1896, the valuations were as follows:

For available phosphoric acid......	4½	cents	per	pound.
For ammonia..............................	13	"	"	"
For potash	5	"	"	"

These figures were based, as usual, on the actual retail cash price of the unmixed ingredients at the seaboard in bags.

From the commercial valuation of a fertilizer, a farmer, by using these figures, can see the actual cash worth at the seaboard of the unmixed ingredients used in the fertilizer. In other words, with cash in hand, he could purchase from seaboard manufacturers the materials used to make up the fertilizer at the valuation given per ton. For interior points freight, of course, must be added. In the bulletins showing the analyses of fertilizers a table giving the various frieght rates from seaboard to interior points is always inserted for convenience of buyers.

AVERAGE PERCENTAGE COMPOSITION OF FERTILIZERS ON SALE IN NORTH CAROLINA FOR SEVERAL YEARS.

Kind of Fertilizer.	Year.	Available Phosphoric Acid.		Ammonia.		Potash.		Relative Seaboard Value per ton of unmixed ingredients.	
		By Analysis.	By Guarantee.	By Analysis.	Bv Guarantee.	By Analysis.	By Guarantee.	By Analysis.	By Guarantee.
Acid phosphates	1890	12.92	12.25	......	......	......	......	$ 10.34	9.80
	1891	12.21	12.06	......	......	......	......	9.77	9.65
	1892	12.25	12.01	......	..	......	......	9.80	9.61
	1893	12.93	12.04	......	......	......	......	10.34	9.63
	1894	13.73	12.00	......	......	......	......	10.98	9.60
	1895	13 29	12.21	......	......	......	......	10.63	9.77
	1896	13.25	11.95	......	......	......	......	10 60	9.56
	1897	12.96	12.15	......	. .	......	......	10.37	9.72
Acid phosphates with potash.	1890	12.04	10 90	......	..	1.77	1.42	11.40	10.14
	1891	11 17	10.29	....	....	1.66	1.50	10.60	9.73
	1892	11 22	9.97	......	....	2.06	1.53	11.04	9.51
	1893	10 38	9.60	......	......	1.78	1.40	10.08	9.08
	1894	11.27	9.77	......	......	1.77	1.47	10.79	9.29
	1895	10.78	9.32	......	......	2.02	1.93	10 64	9.39
	1896	10.47	9 26	......	....	2.01	1.91	10.39	9.32
	1897	10.58	9.66	....	......	1.89	1.85	10.35	9.58
Ammoniated superphates with potash	1890	9.11	8.53	2.41	2 29	2.02	1.71	15.09	14.03
	1891	8.11	8.24	2.59	2.51	2.20	1.88	14.90	14.50
	1892	8.70	8.10	2 63	2 46	2.65	2 12	15.92	14.50
	1893	8.37	8.05	2.59	2 47	2.56	1.97	15.47	14.34
	1894	9.04	8.06	2.85	2.76	2.51	2.21	16.58	15.28
	1895	8 84	7.78	3.26	3.05	2.91	2.45	17.81	15.99
	1896	8.99	8.05	2.99	2 76	2.68	2.33	17.05	15.39
	1897	9 01	8.01	2.85	2.56	2.43	2.13	16.47	14.67

The accompanying table shows the number of brands of each of the three different kinds of fertilizers which fell below their guarantee during the year.

Number.	KIND OF FERTILIZER.	FOUND BELOW GUARANTEE IN									
		Available Phosphoric Acid.		Ammonia.		Potash.		Total.		Valuation.	
		No.	Per Ct.	No.	Per Ct.	No.	Per Ct.	No.	Per Ct.	No.	Per. Ct.
75	Acid Phosphates	15	20	...	....	...	...	15	20	15	20
31	Superphosphates with Potash	4	12.9	...	..	9	29	13	41.9	3	9.7
202	Ammoniated Superphosphates with Potash.	10	5	22	10.9	27	13.4	59	29.2	3	1.6
308	Total	29	9 4	22	10.9	36	15.5	87	28.2	21	6 8

Of the acid phosphates, one brand in every five fell below its guarantee in available phosphoric acid and valuation.

Of the superphosphates with potash, one brand in every eight fell below its guarantee in available phosphoric acid; nearly one in every three in potash, and nearly one in every two in either available phosphoric acid or potash, and one in every ten in valuation.

Of the so-called complete fertilizers, one in every twenty fell below its guarantee in available phosphoric acid, one in every nine in ammonia, one in every seven in potash, nearly one in every thirty something, and one in every sixty-two in valuation.

Or, if we take the average of the whole, it was found that one fertilizer out of every four fell below its guarantee in some ingredent—one in every six in potash, one in nine in ammonia, one in eleven in phosphoric acid, and one in fifteen in valuation.

GENERAL CONCLUSIONS.

(1) The number of brands registered for sale in North Carolina during 1897 is about the same as for 1896, but before that year the number increased very rapidly for each year since 1890, when there was a change from the brand tax to the tonnage tax.

(2) The consumption of commercial fertilizers has increased very rapidly each year amounting to about 208 thousand tons during 1897, valued at about five million dollars.

(3) The larger part of the fertilizers now used in the State are manufactured in North Carolina and Virginia.

(4) The average percentage composition of commercial fertilizers is about the same as for previous years in available phosphoric acid but there are slightly smaller percentages of ammonia and potash than for the two preceding years, probably because these are the more costly ingredients.

(5) One out of every four of the usual fertilizers fell below its guarantee in some single ingredient and one out of fifteen in its valuation.

(6) Except by the actual field trials of the fertilizers there is no method for determining the value of a commercial fertilizer but by chemical analysis, and but for the Fertilizer Control our farmers would be imposed upon by many worthless fertilizers.

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